JOURNAL OF GAS LIGHTING, WATER SUPPLY, &c.

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EDITORIAL NOTES—GAS, &c.

The Board of the Gaslight and Coke Company.

WHEN the proprietors of the Gaslight and Coke Company assemble on the 3rd prox., it will be to find that the six months since they last met have brought about important changes in the *personnel* of the Board who direct their vast interests. Mr. Corbet Woodall will take his seat for the first time at a meeting of the proprietors as the successor of Sir William Makins in the Governorship. Mr. Douglas Walker, K.C., has been appointed to fill the vacancy occasioned by the death of Sir William. Three or four weeks ago, it was rumoured that Mr. John W. Field was retiring through continued ill-health; and this has not only come to pass, but a successor has been selected in the person of Mr. Herbert Jameson Waterlow, of the well-known printing firms to which his patronymic gives title. The old order changeth, and with remarkable strides. The severance of the name of John William Field from—in one capacity or another—the direction and management of the Company, is not an ordinary event. Mr. Field has given of the best years of his life to the most important of all gas undertakings—as Accountant and the faithful henchman of the late Mr. John Orwell Phillips, as Secretary and General Manager for ten years from the retirement of Mr. Phillips early in 1893, and as a member of the Board since Mr. John Birch Paddon relinquished office in 1903. Just as ill-health is the cause of Mr. Field's retirement now, so it was when he brought to a close his career as absolute official chief of the Company. His present physical condition is the penalty of his devotion to the Company and the reputation and traditions of his former distinguished office. While he worked strenuously and self-sacrificingly, there was not, both within and outside the Company, agreement that his devotion was always well directed, nor that his policy and methods were in the best interests of the concern. This is all written in the history of the undertaking; and in that history Mr. Field has left his mark. His final retirement closes a not unimportant chapter in the record. We regret exceedingly the reason that compels Mr. Field to seek rest; and the hope is sincerely expressed that, with this complete detachment from business cares, his health may now be rehabilitated, so that there may be before him the enjoyment of leisure for many years.

Distribution and Negligence.

LIABILITY for accidents in connection with distribution systems is a topic that has had a prominent revival of late in our columns, through the paper read by Mr. F. T. Cotton at the meeting of the Institution of Engineers, through the litigation in which the Gaslight and Coke Company were concerned in connection with the explosions in telephone boxes in Regent Street, and in our columns to-day in connection with an explosion at Cape Town, and a burst water-main at Bristol, which, however, has no identity with the two preceding cases. But between the Regent Street explosion and that at Cape Town, there is in a measure a little resemblance; and they illustrate the increased risks which distributors of gas run through the altered conditions brought about, in the past few years, by the modern introduction of additional public conveniences into our roadways. Being public conveniences, the resulting fresh conditions have to be faced by distributors of gas; and, as the legal interpretation of their position stands at the present time, new responsibilities have been thrust upon them, and consequently extra care and expense in guarding against accident. But however great the care and wariness exercised, not having control over any system or workmen but their own, distributors of gas, as the law is construed, occupy in this matter a very unenviable position. All these new occupants of the roadway create additional disturbance of the subsoil; and this disturbance of the subsoil has anything but a beneficial effect on distribution systems that depend for their security upon the solidity of the soil in which they are embedded. And, moreover, any lessening of the stability of the subsoil surrounding the pipes, has the effect, together with the increasing traffic overhead, of augmenting the vibration to which the pipes are exposed. The greater use of the roadway, too, for public services increases the daily work of competent or incompetent, careful or negligent, workmen; and it also increases, through inspection or other chambers and conduits, the opportunities for the lodgment of gas, the escape of which from the distribution system new conditions tend to abet in greater degree than formerly. The distributors of gas have been mindful of all this; and it attests their caution that, generally speaking, the percentage of unaccounted-for gas has been kept at approximately the old figures, notwithstanding the greater difficulties with which they are beset. This controverts—the changed conditions being considered—the accusation of negligence.

Reference has been made to the increasing exposure to liability that arises through the carelessness of workmen not in the employ of the gas distributors; and the fact has been mentioned that the Regent Street telephone-box explosion (*ante*, p. 121) and the Cape Town explosion have analogous points. In the case of the former, a Post Office telephone man—although the telephone officials were cognisant of the smell of gas in the conduits and boxes concerned—worked at one of the latter with a blowpipe lamp. The consequence was an explosion; but the Gas Company were adjudged, both in the Lower Court and on appeal, to have been negligent and liable for damages for the injury inflicted. The Tramway Company were the injured parties in the explosion that took place in Cape Town; but, although they succeeded in getting from the Gas Company and the Town Council as joint defendants part of the damages for which they applied, they cannot, whatever the judicial view, be justly exonerated from blame in the matter. They had previous warning that there was a smell of gas at a certain point of their system; but notwithstanding a man proceeded to make a "Thermit" joint at that very place, and within about 10 feet of a high-pressure gas main. The Hon. Sir John Buchanan, before whom the case was tried, however, held that there was no contributory negligence on the part of the Tramways Company. In the telephone-box case in London, the Lord Chancellor expressly said (although the Gas Company have to satisfy the claim for damage) "he thought the combined "negligence of both caused the accident." Apart from any consideration as to how the gas came to be to an explosive degree at the point of the accident in the Cape Town tramways system, the dictum of the learned Judge will not be regarded generally as an altogether common-sense one, in view of the foreknowledge of the Tramways Company. But it is certainly a coincidence that his judgment was delivered almost synchronously with that of the Court of Appeal in London in the telephone-box case. It serves to emphasize the legal view as to the liability of gas distributors in such a case.

The Cape Town explosion, however, presents one novel point, the nearest parallel to which in this country could be found in the case of a non-statutory Gas Company whose distribution system is laid through the district of supply by permission of the local authority; and it also adds illustration to the danger of leaving disused pipes and sewers unfilled. Better still is it to completely demolish or remove them. Here was a large disused sewer running through the city, unfilled and unventilated, and this was intersected by a high-pressure gas-main. No better place for the accumulation of an explosive mixture could have been found. The Gas Company, however, denied the presence in the sewer of the gas distributed by them; and they also

denied the existence of leaky joints. It fortunately does not come within our province to decide whether they were right or mistaken. But the disused sewer constituted an ever-threatening danger; and for its survival beyond its useful life, the Town Council were alone responsible. If that empty sewer had not been there, if the unventilated telephone-boxes had not been in existence in Regent Street, there would have been no explosion in either case. As to the other point, which made the Cape Town Council liable for damages jointly with the Gas Company, the latter have no statutory authority; and the streets, being under the control and management of the Town Council, his Lordship found it impossible to hold that the Company carried the gas into the street in question "without the knowledge, consent, and permission "of the Council." Therefore for the part of the claim awarded to the Tramways Company, judgment was given jointly against the Town Council and the Company. But it is difficult to put a finger on any point in the evidence, and say that there the Gas Company were guilty of negligence, unless it be in allowing—it is understood from the evidence this was so—their main at one point to be in direct communication with the interior of the sewer. Otherwise the accident itself was purely uncontrollable on their part; and if the Tramways Company had taken heed of the warning, and had delayed for a single night the making of the joint at that spot, the explosion would have been averted, and there would not have been the disorganization of the tramway traffic. The cases referred to bear witness to the extended liability that modern services in town life have cast upon an old-established one.

In the case of the bursting of a water-main at Bristol which caused damage by the flooding of the premises of a firm of wholesale grocers, the evidence adduced before Mr. Justice Darling and a Jury at the Bristol Assizes forms a veritable technical contribution to the making, and necessary thickness, of large water-mains. Several famous experts were called; and their evidence as to the composition and thickness of pipes for the withstanding of high pressures will be highly valuable to the engineering profession. Their testimony went to acquit the Water Company completely of any negligence, and therefore of liability. The Jury were in favour of the Company on all points; and their vindication was absolute. The details of the case are too many to enter into here; but it is one of first-rate importance to underground pipe-owners, and particularly to water distributors. We congratulate the Company, and especially on the qualitative excellence of the case they presented to the Court. A report fully setting forth the features appears in our "Legal Intelligence."

Workmen's Compensation.

The labours of the Standing Committee of the House of Commons on Law have come to an end so far as the Bill of the Government on the above subject is concerned. The result of numerous sittings has been to greatly alter and extend the scope of the Bill as introduced; and the intention of the Government with regard to it is now matter for speculation. They sustained so many defeats at the hands of their supporters during the progress of the measure as on the occurrence of the last one to prompt the suggestion of an adjournment to give them time to consider their attitude with regard to the Bill. On one of the most important points which was decided against them, a compromise has since been arrived at, which Mr. Barnes, on behalf of the Labour party, declared to be satisfactory. This relates to the reduction of what has been called the "close" time from seven to three days. The longer period is to be restored to the Bill, with the proviso that all serious accidents, involving absence from work for not less than a fortnight, are to be paid for from the date of their occurrence. This will be satisfactory to Mr. Hanbury Thomas, whose letter of explanation with regard to a reference made to him in these columns we had much pleasure in inserting a few weeks ago. It will also be satisfactory to employers generally, who saw in the proposed alteration to three days a great increase of pecuniary liability imposed upon them by the Bill. Logically, however, the case for three days is hardly answerable, unless on the ground of expediency, and especially if the temptation to malingering (which it is generally agreed would frequently be too strong to be resisted under the three days rule) could be satisfactorily guarded against by preventive measures. Practically, the same may be said of the proposed inclusion of the small employer, whether of workmen or clerks; for the latter, as the Bill now stands, are to be entitled to compensation for accidents. This, however, raises a question of far-reaching importance, only, perhaps, to be solved by compulsory insurance. The Government are to be commended for having in this matter desired to act fairly and in a practical spirit. It was pointed out on their behalf that, while liability for compensation usually sits lightly upon the large employer, who almost invariably insures, it might, to the small and struggling employer, mean almost ruin, without securing to the workmen the benefit intended. Compulsory insurance, moreover, which is brought distinctly nearer by these alterations in the Government measure, would in many cases be a hardship. The Bill, however, has not as yet assumed final shape; and—as was recently announced by the Prime Minister—it is to be carried over to the autumn sitting of Parliament. It may not be out of place to mention here a remark that Sir William Selfe made last week at the Brompton County Court, during the hearing of an accident case. He said: "The Workmen's Compensation Act may be "an endowment to lawyers in one sense; but it is a great "blessing to the working people of this country." Sir William added that the Home Office estimated that 150,000 accidents occurred yearly in the occupations to which the Act applied, and statistics showed that not more than 1500 of these cases, on an average, ever came into Court. This is gratifying.

Company Direction and Public Protection.

It is somewhat singular that the Daily Press has not taken greater interest in the important report that the Company Law Amendment Committee have issued, as the result of their appointment in February of last year. The questions with which the Committee deal are public ones; for it is in the joint-stock enterprise of the country that the public finds the most profitable scope for the investment of capital and savings. Two figures supply the proof. There are now more than 40,000 companies carrying on business under the Companies Acts, 1862-1900; and the capital embarked in these undertakings exceeds 2000 millions sterling. In this huge accumulation of capital, the gas industry holds a very respectable share, including the many important concerns established and controlled from this country, but carrying on their operations in European centres, or distant parts of the world. This colossal aggregation of capital is indicative of the immense stimulus that was given to commercial enterprise by the company system as planted by the Act of 1862. But, in the world's affairs, there is seldom success without, in some form or other, the corruption of abuse; and joint-stock enterprise has not been immune. The history of company promotion in the City, of the operations of the financial sharks who live and fatten on the gullibility and easily-stirred cupidity of the public, of reconstructions and liquidations, and of the consequent considerable losses of the people, are dismal evidences of the deficiencies of the laws governing the formation and direction of such joint-stock companies. The gas industry has unfortunately suffered the common lot—thankfully less than most other industries—in being subject to the machinations of unprincipled speculators and of subtle schemers. However, the Committee, whose proceedings were conducted under the chairmanship of Mr. C. M. Warmington, K.C., were appointed to inquire as to what amendments are necessary to improve the law relating to joint-stock companies—not only to correct abuses, but to still further stimulate enterprise in this direction, which, it is feared, has been detrimentally affected by several causes during the past few years, more especially since the passing of the 1900 Act, which was framed for the better protection of, and is still found wanting by, the public.

With the greater part of the report, we have no immediate concern; but, in view of latter-day promotions in the gas industry, the report is worth examination from the standpoint of the defence of the public. With the Committee, we are satisfied that the great majority of joint-stock companies are honestly formed and conducted. The established condition and continuous prosperity that are seen around are too material for denial. But, being also satisfied that where there is integrity there need be no fear of the law, we are at a loss to understand the manifest reluctance of the Committee to strengthen the law, in order the more readily

to lay wrongdoers by the heels, to close the highways that still exist for the imposing of concerns on the public as sound whose instability is well known to the promoters, and to purge the company system, as far as possible, of that irresponsibility of Directors which begets negligence, and frequently financial and other trouble, of which, too, we are not without illustration in the gas industry. Sir Edgar Speyer, one of the members of the Committee, in a personal statement attached to the general report, calls to mind the pertinent evidence of Dr. Schuster before Lord Davey's Committee in 1894, in the course of which he said: "German "law makes a Director liable for non-attendance to his "duties; according to the English law, a Director who "never attends any Board meetings cannot come under any "liability. It seems to me that the immunity of Directors "from liability for negligence lies at the seat of the deplor-"able abuses in company matters in this country."

The Committee, however, in their report appear to err in taking too great a thought for honest enterprise and management, which are well able to look after themselves. "While," they say, "it is desirable, by all reasonable "means, to repress fraud, the utmost care should be taken "not unduly to curtail the facilities and advantages under "which honest enterprise has for so many years flourished, "and still flourishes." The greatest protection there can be for honest enterprise and management is the taking of all possible and legitimate steps in the repression of fraud. Fraud in one direction attacks confidence in honesty in another direction. Therefore our feeling is that the abstention of the Committee from making any recommendations purposing the mending of defects and the restraining of abuses is a decided weakness in their report. On the other hand, the Committee do recommend—and no one will disagree with them—that a Court of Law should be empowered to give relief to a Director or promoter from liability for breach of duty imposed upon him by the Companies Acts, provided that the breach has been occasioned by honest oversight, inadvertence, or error of judgment on his part. But that relief should only be given on convincing evidence; for those who have invented, those who will still invent, and those who use, those things and methods that degrade the company system, will be the most willing to plead oversight, inadvertence, and error of judgment to save themselves from the penalty of their act or want of action. Admittedly the difficulties are many and formidable; but, in the protection of the public, the effectual repression of fraud and negligence are of the foremost importance. While it is agreed that the suggested relief should be given where there is undoubtedly honest oversight, inadvertence, or error of judgment—if there is this relief, it should carry with it a stiffening of liability for proved negligence. Without this, under suggested changes, negligence and other abuses will continue to flourish with greater luxuriance than ever. As Sir Edgar Speyer remarks in his personal statement, it is not Directors who really need protection, but the public.

The Act of 1900 introduced some very stringent provisions regarding the issue of Company prospectuses; but none too stringent. If Directors are incapable of protecting themselves and their honour in connection with the contents of a prospectus to which their names are attached, they are incapable of looking after the interests of shareholders, and ought not to be in office, much less rewarded by fees. No prudent man need be frightened from accepting a directorship; for his prudence will be his defence against any false step. The Committee make only one suggestion in connection with the issue of prospectuses. Since the Act of 1900 came into force, the tendency to float Companies without prospectuses has greatly increased. In the absence of a prospectus, there is no representation of prospects and assets; and the buyer of shares has no redress in the event of fraud later on coming to light. The Committee, therefore, suggest that it is desirable that all Companies before beginning business should file a preliminary statement with the Registrar. But, certain recent Company prospectuses have shown that there are sins of omission as well as of commission, and that the public can be inveigled by borrowed reputations and artificial prospects, constructed on an altogether dissimilar condition of things. That is a matter for consideration; and, while on the question of amendment, the lax conditions that now exist in many Companies as to the financial commitment of Directors also require repair. Experience further suggests that, in the direction of industrial enterprises, it would not be amiss if it were statutorily decreed that at least one Director in every Company should possess "practical knowledge and experience" in the business the Board are called upon to administer. The care of shareholders' property and customers' interests are just as important as (say) the testing of the gas supply of the Metropolis.

The law relating to joint-stock enterprise is undoubtedly still very defective; but the latest report on the subject is not strikingly suggestive of methods whereby the public may be effectively protected. The Committee appeared to be primarily concerned in discovering means whereby to counteract the late diminution in the registration of new Companies. Lukewarm comfort will be found by Gas Companies controlled in this country, and carrying on operations abroad, in learning that the Committee have not overlooked the retarding influence to the further promotion of Companies so circumstanced of recent decisions as to the payment of income-tax. Some Gas Companies are paying income-tax twice over—at the seat of operations and in this country. Such hardships as these, it is feared, will tend more and more to the transfer of the centre of administrative control.

Results at Stafford and Burslem.

The two reports of the working of corporation gas undertakings during the past financial year of which we are able to furnish particulars in this week's issue, are both of a very satisfactory character. At Stafford, the business shows a steady increase; the consumption of about 188 million cubic feet being a little over 8½ million feet more than that for the preceding twelve months. A particular feature of the report is the unaccounted-for gas, which is on the present occasion no more than 2 per cent. of the make, as against 5·47 per cent. a year ago. The gross profit of £13,546, is slightly better than the previous year's record profit; and this result, it is pointed out, has been attained notwithstanding a reduction in the price of gas to power and other users which came into force at the commencement of the year, and which affected the average receipts by rather over 1d. per 1000 cubic feet of gas sold. Everything connected with the undertaking seems to point to the general success of the bonus, or profit-sharing, scheme at Stafford; and the Town Council were certainly fully justified (as recorded last week) in expressing their confidence in Mr. Hubert Pooley's management of the works. With the employment of a better class of coal, the make of gas per ton at Burslem has increased largely during the past two years. In 1903-4, it was 10,163 cubic feet; in 1904-5, 10,964 feet; while for the past twelve months the very gratifying figure of 11,317 feet is recorded. The result of this has been an increased output of 2 per cent., along with a reduction in the quantity of coal carbonized of 1½ per cent. The Chairman of the Gas Committee, however, is not even yet entirely satisfied; for he has noticed that "a neighbouring undertaking" obtains 12,000 cubic feet per ton of coal, and is ambitious to equal or even beat this. In spite of a substantial falling off in the receipts from residuals, the gross profit is practically the same as for the previous year, though one or two special items have greatly reduced the net profit on the present occasion. Much attention has been devoted to placing the undertaking on a thoroughly sound financial basis; and this having been now achieved, there are hints of a possible reduction in price to at least two classes of consumers—users of prepayment meters, and those who consume gas for power purposes.

The Dublin Corporation's Defiance.

There does not as yet seem to be any sign of a termination to the deadlock which has arisen between the Corporation of Dublin and the Local Government Board Auditor. It will be remembered that in last Tuesday's "JOURNAL" the statement was made that a second special meeting of the City Council had been called to consider a fresh development of the case. It was announced that a discovery had been made that Mr. Drury (the Auditor to whom the Corporation object) was appointed illegally, and that the Auditor should in reality have been a different person altogether. Under these circumstances, it was thought that the

Council might revoke their former resolution not to appeal against the judgment of the Lord Chief Baron (who granted a *mandamus* requiring the production of the books and accounts for audit by Mr. Drury), in order to secure a judicial decision on the new point raised. The meeting was duly held; and the Lord Mayor advocated an appeal, which he said he would not consider a "climbing down." In reply to remarks, he added that the legal costs up to the present amounted to £600 or £700, and that the appeal would not cost more than another £300. This appears to be a very stiff price to have to pay for an unsuccessful endeavour to oust Mr. Drury from his position of Auditor of the Corporation accounts; but whatever the final upshot may be, the ratepayers are at least to be spared the expenditure of the extra £300, for the proposal to appeal was lost by a majority of more than two to one. The Corporation have all along claimed that the ratepayers have been overwhelmingly in favour of the course of obstinate resistance on which their representatives have embarked; but the accuracy of this view would seem somewhat open to question, judging from the applause in the public gallery when one Councillor asked whether the Auditor stated in his report that there were some members of the Council who had not paid their rates, and if this was not the key to the present attitude. The Councillor in question followed this up by naming three members who, he alleged, were guilty of corruption. The Lord Mayor protested that the public had no right to applaud a charge made against the Corporation; from which it seems that in Dublin what is "sauce for the goose" is not "sauce for the gander."

A Water-Rate Unification Scheme for London.

Those of our readers who followed the discussions on the water supply of London which preceded the formation of the Metropolitan Water Board will doubtless remember that one of the advantages contemplated from concentrated management of the undertakings was a reduction in the charges for water, or, if these remained unchanged, the production of a profit which would be applicable in relief of the ordinary rates. The framers of the Bill constituting the Board, or, all events, the Committee to whom it was referred, were, however, not very sanguine on these points, for they specified that the Board were not, until Parliament otherwise determined, to reduce the charges below those in force in the quarter ending June 24, 1902, unless they were satisfied that the reduction would not cause a deficiency in the water fund. But while forbidding an action which would be financially prejudicial to the concern, the Committee recognized the advisability of altering the existing rates as soon as possible; and therefore they specified that, within three years from the date of the Board entering into possession of the undertakings, a Bill was to be introduced into Parliament "providing for uniform scales of charges applicable throughout the limits of supply." The Board were fully alive to the importance of this matter; and it was their intention to give notice last November for a Bill for the present session. But the subject was found to be too intricate to allow of this being done. It will be seen from the report which appears elsewhere, that the Committee recommend the substitution for the existing variable rating of a maximum charge of 5 per cent. for water supplied for domestic purposes, which is to include high service, baths, and water-closets. Under the present system, the revenue (including domestic "extras"), based on the assessments prevailing prior to the recent quinquennial revaluation, works out to £1,849,598—the percentages on the annual value of premises supplied ranging from 3·27 up to 6·16, or an average of 5·06. Under the proposed uniform rate of 5 per cent.—which reduces the rating on houses of the annual value of £31 up to £200, and levels up that on houses of higher value—the revenue would be £1,828,436, or a net deficiency of £21,162.

Mr. H. D. Madden has been appointed Resident Manager at the Grangetown works of the Cardiff Gas Company. Mr. Madden has been thoroughly well prepared for the duties he will have to discharge, having had varied experience with the Gaslight and Coke Company, in whose service he was for some time.

We learn that Mr. W. Newbigging has intimated to the Gas Committee of the Macclesfield Corporation his desire to terminate his engagement as Engineer and Manager, in order that he may devote more time to his private practice. The matter is in the hands of a Sub-Committee, with the view of coming to some arrangement with Mr. Newbigging.

Since the death of Mr. James M'Gilchrist, the management of the Dumbarton Gas-Works has been in the hands of Mr. Joseph G. M'Geachin, the Senior Assistant. We learn that he has now been raised to the position so long filled by his late chief, under whom he gained valuable experience. He is 28 years of age, and has been engaged at the works about ten years.

GAS STOCK AND SHARE MARKET.

(For Stock and Share List, see p. 260.)

The week just concluded on the Stock Exchange opened with a fair promise of improvement. Things were very quiet; but there was a calmer feeling, and prices began to look up a bit. However, it was soon over. The cheerfulness began to give way before the close of Tuesday, and by Wednesday the situation was getting very gloomy—the chief cause of the depression coming from the Russian quarter. Matters were worse on Thursday; and Consols and Russians were conspicuous by their weakness, everybody being a seller without any buyers. Friday was the worst day of the week, as Fridays often are; there being almost a rush to realize, and Consols actually going as low as 86¾. On Saturday, the intense nervousness was somewhat relaxed, and a better feeling marked the close. Movements in the Money Market were very irregular almost from day to day, alternating between ease and scarcity. It was difficult to arrive at any definite tendency; but rates were getting steadier towards the close. The Gas Market furnished a bright particular exception to the oppressive gloom and flatness which brooded in other departments; being high in public favour, and attracting much attention and support. The result was that several quotations effected improvements of considerable magnitude; and the advance, though most conspicuous in the companies of the Metropolis, was not confined to that area, but extended to representative undertakings of the industry in all parts. The Metropolitan advance started from the announcement that the Gaslight and Coke Company would be able to carry forward more than £210,000 after paying the same rate of dividend as last February. This gave the utmost satisfaction; and the ordinary stock, after opening at 98¾, ran up to 102 on Friday (a rise of 2½ in the quotation). The secured issues were active, but unchanged. The maximum was done two or three times at 89; the preference marked from 109 to 110⅜; and the debenture from 86⅛ to 87. South Metropolitan participated in the buoyancy to a similar extent—putting three points on to its quotation, with business marked at from 130½ to 134. Commercials were very quiet, only the 3½ per cent. changing hands at 111½; but each of the capital issues advanced a point. In the Suburban and Provincial group, British marked from 41 13/16 to 41½ (a fractional fall), Bournemouth preference 15¾, Brentford new 200 and 201, Brighton original 232, ditto ordinary 166½ and 167, and Lea Bridge 121⅛ and 121½. Among the Continental Companies, Imperial was active and in good strength, with several transactions ranging from 178 to 180, the higher figure being marked several times. The rest were very quiet; Union being done once at 125, and European not touched at all. Among the undertakings of the remoter world, Bombay fully-paid changed hands at 7, and Oriental at from 148½ to 152 (a rise of 3 in the quotation). Buenos Ayres was busy, and marked from 11 7/16 to 11⅜ (a fractional rise), Primitiva 6 7/16 and 6 5/32, ditto debenture 96½, River Plate 12¾ and 12 9/16, ditto debenture 97½, San Paulo from 13¾ to 14 (a fractional rise), Monte Video 11 3/32, and Cape Town 16½.

The closing prices are shown in our Stock and Share List on page 260.

NOTES FROM WESTMINSTER.

The Truro Gas and other Bills.

Committee work on Private Bills is rapidly drawing to a close. On Friday last there were no less than 21 Bills to which Royal Assent was given; among them being the Removal of Sulphur Restrictions Bill. The passing of the Pontefract Bill with its clauses for the compulsory purchase of the Gas Company's undertaking was noticed editorially last week; so that reference in these notes is unnecessary. The Tottenham and Edmonton Gas Company's Bill was before the Lord Chairman last week; and it will now complete its passage through Parliament. The Unopposed Bills Committee of the House of Commons have had before them two more Gas Bills. One is Crediton; and the Company—in order to keep at peace with the District Council—have agreed to a further reduction in their proposed capital powers. Starting with £27,000 in their Bill, they have now dropped to £14,000. They have also undertaken not to pay more than 5 per cent. dividend, until the price of gas has been reduced to 4s. 6d. per 1000 cubic feet.

The other Bill was that of the Truro Gas Company. By agreement with the Corporation, a purchase clause has been inserted in the measure, and there were the conditions attached that it should be operative within twelve months of the passing of the Bill and that the Corporation should take over the "liabilities, mortgages, and other obligations." These included a sum of £8000 of irredeemable stock; and the Local Government Board appear to entertain grave objections to municipalities being saddled with stock that is not redeemable. The Committee relieved the clause of the provisos referred to; so that, if a Purchase Bill is brought up by the Corporation, it will have to work out its own salvation with that irredeemable stock in the way. Apart from these matters, the Truro Bill, as our summary of the provisions in

the "JOURNAL" for Jan. 2 last showed, is of exceptional interest, and it has been taken through its parliamentary course with comparatively little change, mainly through the instrumentality of Mr. Browne (of Messrs. Dyson and Co.), who has been assisted by Mr. D. Irving, of the Bristol Gas Company, Mr. S. J. Ingram, the Engineer and Manager of the Truro Company, Mr. John James, the Chairman, and Mr. J. P. Paull, one of the Directors. The Bill has been somewhat extended by the insertion of the purchase clause, and of protective ones for the Great Western Railway and the County Council of Cornwall. Two outstanding features in the success of the Bill are the fact that the Company have carried through both their 13-candle gas proposal and the clauses authorizing the Company to supply power gas. Among the power-gas clauses, however, now appears one which will subject the business to any regulations that may hereafter be made by the Secretary of State, or to any future general legislation. The standard price for ordinary gas under the sliding-scale has been reduced from 4s. 3d. to 4s. 2d. per 1000 cubic feet; but the discount clause has not been altered. It gives that abundant liberty which we have contended for in the "JOURNAL." Discount for prompt payment is not to exceed 25 per cent., but for large consumption, or in respect of gas supplied by contract or for motive power, the discount may be "upon such scale and subject to such conditions and regulations as may be prescribed by special contract in writing between the Company and such consumers."

It is only a fortnight ago that the Great Yarmouth and Lowestoft Water and Gas Bill was referred to in the notes on its issue from the Lords Committee. Already it has got before a Commons Committee, and was being freely discussed at the end of last week, and again yesterday. It will be noticed next week.

Gaslight and Coke Company's Dividend.

We are informed by the Secretary of the Gaslight and Coke Company (Mr. H. Rayner) that the accounts for the past half year show that—subject to audit—the balance to the credit of the net revenue account will enable the Directors to recommend the payment of a dividend at the rate of £4 8s. per cent. per annum, carrying forward a balance of £210,481 3s. 9d. This result compares with a dividend at the same rate for the June half of last year, with a balance of £217,408 carried forward.

Use of Iron Pipes for Water-Works.

Mr. F. P. Stearns, the President of the American Society of Civil Engineers, took as the subject of his annual address "The Development of Water Supplies and Water Engineering." In the course of his remarks on distribution, he said the date when iron pipes were first used for water-works was uncertain. There were instances of their employment as far back as the middle of the eighteenth century; but they did not come into general use until after the beginning of the next century. In 1746, the Chelsea Water Company laid a 12-inch flanged pipe to a reservoir in Hyde Park, and it was taken up and relaid in 1791 "in consequence of its joints being perished." Another pipe laid a few years later in Kensington Gardens was taken up in 1819 on account of incrustations on the interior surface. A 5-inch iron pipe was laid to supply water to Edinburgh in 1787. The London Water Companies changed from wooden to cast-iron pipes between 1810 and 1820. Mr. Thomas Simpson, the Engineer of the Chelsea Water Company, designed the first spigot-and-socket pipes about the year 1785, and at that time laid a few lengths of this pipe with lead joints as an experiment. In 1804, Philadelphia had about three-quarters of a mile of iron pipe laid as an experiment, and in 1817 began to use cast-iron pipes with sockets, similar to those now in use. These pipes were imported from England. It is of interest to note that as early as 1810 a 15-inch flexible cast-iron main, with ball-and-socket joints at intervals, was laid across the Clyde to supply water to a portion of Glasgow. A trench was first dredged in the bed of the river, then the pipes, attached to wooden frames, were connected on land on one side of the river, and subsequently dragged across it until one end reached the opposite shore, the operation being aided by pontoons, much in the same manner that such work is done at the present time.

North British Association of Gas Managers.—The 45th annual general meeting of the Association will be held in Edinburgh on Thursday and Friday of this week, under the presidency of Mr. W. B. M'Lusky, the Gas Engineer to the Corporation of Perth. The business (to be transacted in the Masonic Hall, George Street) will include, besides the President's address, three papers: "Illuminating Power and Lighting Efficiency," by Mr. W. R. Herring, of Edinburgh; "Construction of New Gas-Works," by Mr. T. Lighbody, of Renfrew; and "The De Brouwer Stoking Machinery at Alloa," by Mr. J. W. Napier, of Alloa. On Thursday night the members and lady friends will dine together in the Balmoral Hotel, Princes Street. The morning of Friday will be devoted to a drive to the Forth Bridge; and after luncheon, a visit will be paid to the new gas-works at Granton, by permission of the Edinburgh and Leith Gas Commissioners and Mr. Herring, their Chief Engineer. Light refreshments will be served during the inspection of the works.

ELECTRIC LIGHTING MEMORANDA.

A Peculiar Scheme for the Lighting of Oxford Street—The Eviction of Electricity at Coatbridge—The London County Council at Work upon a New Scheme—The House of Lords and House Wiring—Electric Lighting Provisional Orders—Commercial Advancement and Works Modernization.

NOT by merit, but by carving up and twisting about the original scheme, a majority of the Marylebone Borough Council have obtained the lighting of Oxford Street for their burdened electricity undertaking. In the original report of the Lighting Committee on the subject, incandescent gas lighting was the favourite method. It was cheaper than electricity; and the illumination distribution was better than could be obtained by electric lighting. But, at the behest of the Electricity Committee, the Lighting Committee have performed that evolution known as "right about face." The revised decision of the Lighting Committee has been come to entirely on an altered scheme for electric lighting, which, by certain manipulations to which reference will be made presently, has been reduced, by a few pounds, in annual cost below that of the scheme of the Gas Company, from which they declined to depart. Oxford Street will shortly furnish an excellent study in light and shade. One of the methods of reducing expense has been by adopting the simple expedient of making the ratepayers throughout the whole district of the Borough Council pay immediately for the cost of installation—£2500, or nearly £1000 more than the cost of installing gas. [Since the report was adopted, it is announced that the Electric Lighting Committee have decided to erect thirty pillars with double and single lights, at an estimated cost of between £3000 and £4000. There is a material difference between this and the £2500 that requires some explanation.] This method of clearing off the initial expense kills two birds with one stone. An application for a loan for arc lighting might have been rejected; and that contingency is avoided. Secondly, the immediate payment by the ratepayers of the initial cost will make the annual expense appear smaller by the amount that would be represented by repayment and interest. Another plan by which expense is to be saved is this: Oxford Street is to be lighted by 81 flame arc lamps, 36 of which are to be discontinued half an hour after midnight. In the cause of economy necessitated by the use of an expensive system of lighting, the difficulties of the police in the West-end will not be lessened. Further economy is to be effected by placing 70 of the flame arcs on columns 22 or 25 feet high, on refuges in the centre of the road—two on each column—and six singly on other columns, with only five on footpath columns. Was ever more ridiculous scheme proposed for one of the finest streets in London? How is it expected to get anything like uniform distribution? Between the Marble Arch and Tottenham Court Road, there are only to be 41 of these central columns, and 35 of them will support two lamps each. These lamps are alleged to be of 1500-candle power; so that, assuming this is approximately correct, there will be 35 centres of light equal to 3000-candle power, costing each about £42 per annum. The greater part of both illumination and cost will be diffused up aloft. The author of this peculiar scheme is Mr. Arthur Wright; but it is stated that he would not have produced it except on pressure by his Committee. It may be anticipated that before long some intermediate lamps will be required (particularly at dangerous turnings) so as to reduce the deep shadows that will be thrown. There are several members of the Council who see danger ahead, and who would rather have in Oxford Street the comfortable security that gas gives than the disconcerting performances of the electric light. A price of £42 per double-light column and £21 for single ones, without the initial expense, is heavy for striking displays of local brilliance, which will be largely wasted. The annual cost of the lighting under the new scheme will be £1675, as against the Gas Company's estimate of £1681. The various figures show how beautifully the whole business has been manipulated for the benefit of the Electricity Department. The lighting will be an interesting illustration of how not to illuminate an important thoroughfare. Later on, the time to inspect it will be after the shop shutters are up or down, as the case may be.

Ten years may be taken as a fairly good time within which to gain experience, and to come to a decision. Consequently, it will not be alleged that the Town Council of Coatbridge have acted precipitately in giving the Electric Light Company notice to quit their streets so far as public lighting is concerned. It is a decade or thereabouts since the Council entered into a contract with the Electric Light Company for partial street lighting; and the lighting has never been a success, through the unsteadiness of the current, and as to the charges they have not been in any way comparable with gas. The matter is reported upon elsewhere in this issue; and interesting details from the successful tender of the Gas Company will be found set out. It will make the electricians rub their eyes a bit to find that the Company are able to replace arc lamps, for nine months' lighting, with 300-candle power self-intensifying gas-lamps for £4 19s. each (all-night lighting), or £2 15s. for half-night lighting, and Nernst lamps with 100-candle power Kern burners for £3 5s. (all-night lighting) and for £2 0s. 6d. for half-night lighting. The initial expense to be incurred by the change will only be £220; and therefore such a small sum might with advantage be wiped off at once. The present contract is only for the season; but seeing that the

Gas Company are working under the sliding-scale, the Council are safe in respect of cost in the future. The Company will well defend their restoration to full possession of the street lighting.

It may be taken that there are about one-third of the members of the London County Council who are against that body becoming responsible for such a gigantic scheme as that which the Board of Trade and the recent Hybrid Committee of the House of Commons, in their extravagant view, think desirable for the proper supply of electricity in London. But there are the other two-thirds; and that overwhelming proportion of the Council is mostly composed of those who profess and call themselves Progressives—progressive in running into debt, in increasing the rates, in speculation, and in many other things. Their pride is great that the Hybrid Committee should have named the Council as the proper authority to carry out such a mammoth scheme as is considered desirable. No time is to be lost by the Council in showing Parliament what they can do. In the present session, what they have chiefly shown has been that their appreciation of what is necessary for London does not accord with that of Parliament; and therefore this should have been sufficient ground for declaring the Council's incompetence for shouldering the responsibility of such a project. Last Tuesday, the Highways Committee, in the face of a not insignificant opposition, obtained the sanction of the Council to take such action as is necessary in order that a big electricity scheme may be at once formulated; and for this a special maintenance estimate of £1500 has been endorsed. One member of the Council is Mr. B. S. Straus, M.P.; and he appears to think that a reasonable scheme will lead to the relief of the rates. When? And what is a "reasonable" scheme? Is it one proposing to supply electrical power throughout not only London, but 280 square miles outside, with all losses attaching to the scheme, though incurred beyond the Administrative County of London, coming upon the ratepayers within? The Progressives have got their way so far; and after the summer vacation, we shall see what kind of scheme they have succeeded in hatching. We hope it will be something of a more presentable character, and with less vagueness about it, than their last effort.

The changed attitude of the House of Lords in connection with the clauses of the London County Council (General Powers) Bill, by which the Borough Councils are to be enabled to do electrical wiring and supply fittings, has been explained. Although the House of Lords is not subject to change in its *personnel* as is the House of Commons, continuity of policy in connection with Private Bill Legislation appears to be a small matter. Their decisions depend on the Committee appointed to consider a Bill. Whatever a Committee agree to, the House will endorse. Last year the electric wiring clauses—the third time they had been asked for—came before the Duke of Northumberland's Committee, and were rejected; this year they came before the Earl of Camperdown's Committee, and were allowed. In the House, when the Bill came up for third reading, there was an attempt to get the clauses expunged; and this resulted in a little straight talk on the subject of municipal trading. The Earl of Wemyss is a forcible antagonist of all municipal trading; and so little does he think of the trading ability of county (and we suppose other) councillors when personal financial interest is not involved, that he would—he was probably in a merry mood—compel councillors to undergo an examination before a Government inspector upon all subjects with which they would have to deal. It would certainly be, if practicable, an effectual way of weeding out the inefficient from the efficient. But there would be a paucity of candidates. Not many of those who at present determine the spendings of a community would be minded to undergo any catechizing at the hands of an inspector now that their school days are over, or would care to face the ridicule that would meet them on being "plucked." There were several of their Lordships against the granting of the clauses; but a greater number who were averse to their rejection. The Earl of Camperdown avows himself as much opposed to municipal trading as the most pronounced anti-municipal trader the Upper Chamber can produce. But the primary reason why his Committee gave the power to the Borough Councils is that they are of opinion that the distributing authority should have the right to supply fittings in the interests particularly of the small consumer. The interests of the majority, as represented by the ratepayers, apparently do not count. This is misplaced concern for the interests of the "poorer inhabitants" of the Metropolis, because the poor can no more afford to pay several pounds a year extra for artificial light than they can afford to ride with the same frequency in cabs that they do in omnibuses or the County Council trams. There is a little electrical chuckling over the success of the clauses this year, as it is believed that their possession will do something "to counteract the recent virulent outbreak of gas competition." The counteracting has not been the experience in Woolwich and Marylebone, nor in the provincial towns in which wiring powers are in existence. The London Gas Companies will not fear the use of the powers in the sixteen additional boroughs in which the clauses will now come into operation. It is the opinion of the Earl of Camperdown that the powers will not operate against the private trader. The private trader holds contrary views, founded on past experience. It is also interesting to note that *now* the Board of Trade "see no reason for refusing a power already enjoyed by gas companies." The fact that the latter use private and not public money is left out of account.

The report of the Board of Trade respecting their proceedings during the past year under the Electric Lighting Acts, 1882 to 1902, has been published. There is always interest to be extracted from this annual document. In December last the applications received for Provisional Orders numbered 55; 24 being by local authorities and 31 by companies or "persons." The applicants coming under the category of "persons" were few and far between; and we know that "persons" who apply for Orders as a first step to speculative business for the purpose of self-enrichment are not regarded now with any particular favour by the Board. The 55 Orders applied for make the lowest number since 1897; and 49 of the 55 have been granted. It is noticed there are three cases in which Power Companies applied for Orders for districts in which the Local Authorities refused their consent, and in which the Board of Trade decided to dispense with the consent. On the other hand, there are four cases in which Companies of various descriptions had not obtained the consent of the Local Authorities, and, not satisfying the Board that consent should be dispensed with, were refused Orders. In other ways, the Board evinced some disposition to hold the balance evenly. In the case of Wembley, applications were made by both the District Council and the North Metropolitan Electric Power Distribution Company; preference was given to the application of the Council. The rural district of Gelligaer and Rhigos has not previously been heard of as a likely area for a profitable business in electricity supply; but evidently the Rural District Council thought it was, and made an application for the necessary powers. It does not cause surprise to learn that representations were made from ratepayers and others, objecting to the application. An inquiry was held by the Board; and they found the circumstances such that they declined to invest the ambitious Council with the necessary powers. Another point of interest is that, since the last report, the Board have approved deeds transferring the powers, duties, and liabilities of fourteen holders of Orders—to Companies, in all but one case. No applications for Licences have been entertained since the date of the last report. A table appended to the report shows that since 1883, and prior to the applications dealt with above, the total number of Electric Lighting Orders applied for was 1233; made by the Board, 981; confirmed by Parliament, 965. A goodly proportion have since been revoked or repealed—viz., 205. Over that long term of years, the number of Licences applied for is only 49. Of these, 33 have been made by the Board, and 33 have been revoked, repealed, or have expired; so that, like the snakes of Ireland, to-day there are none.

It has been rightly said that figures may be made to prove anything; and it may be added that no better school has been found than the electrical profession, especially when its members turn their attention to gas competition. The "Expert" writer on electrical supply in the "Municipal Journal" has been congratulating all and sundry on the "business advancement" there has been in electricity supply, which "has been accompanied by activity in modifying and modernizing the engineering arrangements." In taking Blackpool, he was not happy in his illustration of that wonderful business advancement of which he speaks, for that town has only added 4, 26, 55, and 76 consumers, in the last four years, respectively. This is truly magnificent; and it shows how the "commercial" side of the undertaking has been stimulated. We learn that "reductions in the charge for private lighting being possible on a reduced cost-sheet, have brought about an increase in the output and the number of new consumers, which is rendering it easy to compete with gas even under the present competitive conditions." "Easy" though it be, the additions of new consumers do not show a highly successful result; and the intelligence has not reached us that the Gas Engineer is yet in a despondent mood. Of course, he may not have heard of his competitor's increase of 161 customers in four years! The real improvement in the position of the Blackpool electricity undertaking is found in the reduced consumption of coal (notwithstanding an increased consumption of electricity), together with the high charge per unit for public lighting—viz., 5·161d. per unit, compared with 3·621d. for private lighting. Thus we see how the ratepayers of Blackpool are compelled to unduly subscribe, through the public lighting, to the revenue of the electricity undertaking, by being, whether they like it or not, the customers at the heaviest rate. The "Expert" does not appear to be very particular about his statements and conclusions; for, in dealing in the same issue with the Hanley electricity accounts, he says: "The plant at Hanley has not been subjected to the process of elimination and modernization which has had such a marked effect on the costs at Blackpool and other places." At Hanley, the plant is quite as modern as that in use elsewhere, and it includes stokers, elevators, conveyors, &c.—the very plant that "Expert" says has brought about such "economy of production" at Blackpool.

The James Mason Laboratory, which was opened last Friday by Lord Carrington, is a new addition to the laboratory buildings attached to the famous experimental station at Rothamsted. It is the gift of Mr. J. F. Mason, M.P., who has presented it to the Lawes Trust in memory of his father, the late Mr. James Mason, of Eynsham Hall, who for many years carried out on his own estate experiments on the fertility of the soil and the means of increasing it. The new building is to be devoted to agricultural bacteriology.

OBITUARY.

JAMES ALFRED WANKLYN.

We regret to record the death last week of Mr. James Alfred Wanklyn, which took place at his laboratory at New Malden, Surrey, in his 73rd year. Deceased was widely known as an analytical chemist, and his processes for the analysis of air, bread, milk, and water, on which he had written books, are employed in the Government laboratories in England, India, and South Africa. He was also an authority on the treatment of sewage. His "Water Analysis" was a practical treatise, prepared in collaboration with Mr. Ernest T. Chapman, on the examination of potable water by the ammonia process. It was first published in 1868, a year after the origination of the process; and it has passed through several editions—the seventh having been issued towards the close of 1888. With regard to this process, its author said that, having been discovered about a generation before chemists were prepared for it, it had been condemned with more virulence than probably any other; and yet it had "surmounted every obstacle, and attained to general recognition all the world over for its pre-eminent utility and trustworthiness."

By the majority of our readers, however, Mr. Wanklyn's name will be best remembered in connection with the Cooper coal-lining process, on which he contributed some articles to the "Journal" in the first half of 1883. Its inventor—Mr. W. J. Cooper—aimed at effecting a fundamental change in the production of gas by rendering the coal powerfully and permanently alkaline by mixing caustic lime with it before it was put into the retort; and assuming that an absolutely perfect admixture of the two substances could be realized, it was claimed that no trace of sulphuretted hydrogen or sulphuret of carbon could possibly arise, and that the crude gas would consequently issue from the retort devoid of sulphur in all forms. A great deal of interest in the process was aroused at the time, and it was mentioned by Mr. R. O. Paterson, the President of the Gas Institute, in his address at the meeting in Sheffield in the above-named year. While giving credit to Mr. Cooper for his attempt to make a new departure in the distillation of coal, whereby, as he claimed, an increased yield of ammonia, a higher illuminating power of the gas, the abolition of lime purifiers, and an improved quality of coke could be effected—advantages which, it was recognized, would bring about economy if capable of realization—Mr. Paterson pointed out that results on a working scale would be required before the claims made for the process could be accepted. An experiment was conducted by Mr. Wanklyn at the Vauxhall Gas-Works, by permission of the then Engineer (Mr. P. J. Wates), and the results, which were recorded in our columns at the time, were regarded as satisfactory. Prior to the meeting of the Gas Institute, however, the subject had occupied the attention of a gathering of gas engineers; for at the spring meeting of the North of England Association a paper on his process was read by Mr. Cooper, which gave rise to an interesting discussion. Mr. Hack, of Birmingham, followed with another paper, at the Midland Association meeting a year later. It is unnecessary to refer further to the process, except to mention that it was tried by Mr. Duxbury at Darwen, by Mr. Barnfield at Swanage, and Mr. Spice at Tunbridge Wells; but of late years it has altogether been lost sight of.

Reverting to the event which has called forth the preceding references to a topic which rather more than twenty years ago was a very live one among gas managers, and in the discussion of which the late Mr. Wanklyn took a conspicuous part, we may mention that the deceased was a member of the Royal College of Surgeons, a corresponding member of the Royal Bavarian Academy of Sciences—an honour seldom bestowed on foreigners, but shared with him by Professor Edward Frankland, Professor Faraday, and Dr. Angus Smith—and Professor of Chemistry in the London Institution.

THE IRISH INTERNATIONAL EXHIBITION.

Progress of the Undertaking.

A large company assembled last Tuesday in one of the buildings in progress for the above-named exhibition—an important section of which, as our readers are aware, will be devoted to gas—and heard from the Chief Executive Officer (Mr. James Shanks) an interesting statement in regard to the progress of the undertaking, its scope, and the local and general support which is being given to it. The visitors saw that already substantial advance has been made with the erection of the Central Hall and the Power and Machinery Section; and with nine or ten months still available, there is every reason for expecting that when the opening day arrives the exhibition will be quite ready. The superficial area of the entire centre building, including the four wings, is nearly 100,000 feet; and the area of the Machinery Pavilion will be 90,000 feet. In the course of his address, Mr. Shanks mentioned the names of a number of prominent English and Irish firms who will be represented at the exhibition, and dealt in detail with the various sections. He explained that provision had been made for a very large display by electrical engineering firms, among them being the British Westinghouse Company; while several gas-engine makers—such as Messrs. Crossley Bros., the National Gas-Engine Company, and others—were arranging to exhibit. The makers of electrical plant have not, so far, shown themselves to be quite alive to the advantages of the exhibition. But Mr. Shanks acknowledged that this could not be said of the gas contractors; for, through the exertions of Mr. Francis T. Cotton, the Secretary and Manager of the Alliance and Dublin Gas Consumers' Company, a powerful Committee had been formed in London, and it was expected that they would fill a building, to be specially constructed for their occupation, with all varieties of gas appliances for lighting, cooking, and heating. Mr. Shanks added that the Gas Section would be an important exhibition in itself; and additional interest was lent to it from the fact that the Institution of Gas Engineers had arranged to hold their annual meeting next year in Dublin. The gas industry would therefore be very strongly in evidence. After offering some information in regard to the other sections, and mentioning the favourable attitude of foreign countries towards the project, Mr. Shanks passed on to deal with the musical arrangements, and concluded by expressing the hope that what the visitors had seen and heard would convince them that a good move had been made with the work, and that behind it there was an organization capable of effecting whatever might be necessary to secure a satisfactory result. It only remains to say that the Executive Council have issued an artistic pamphlet on the exhibition and the attractions of Dublin, with views of the principal buildings, which will be found useful by visitors.

ISLE OF WIGHT GAS ASSOCIATION.

The members of the Isle of Wight Gas Association—about 25 in all—journeyed to Portsmouth last Thursday to accept the invitation that had been sent them by Mr. J. D. Ashworth, the Engineer and General Manager of the Portsea Island Gas Company, to visit the various works under his control.

On their arrival at the gas offices next the Town Hall, the members were hospitably entertained to luncheon by Mr. Ashworth, whose thoughtfulness in this respect was afterwards suitably acknowledged on the proposition of Mr. F. F. Farrand, of Ryde, the Chairman of the Association at this meeting. The various offices and show-rooms of the Gas Company, as also of the allied Portsea Island Gas-Fittings Company, Limited, proved a great attraction to the party; and the thoroughness with which all the work of the departments was carried out was much admired. The party subsequently drove to the Rudmore works—one of the gasholder stations of the Company, as also the site of the works for the repair of meters, and the cleaning and repair of the gas-stoves lent on hire. There is a Botley carburetting plant at work here. A large number of the Company's workers were seen busily engaged in their various operations.

The principal object of the visit to Portsmouth was, however, to inspect the new Hilsea Gas-Works—a full illustrated description of which was given in the "Journal" last October [Vol. XCII., pp. 24 and 100]. Under Mr. Ashworth's direction, a careful examination of the whole of the plant was undertaken; and many were the expressions of approval of the manner in which the plant had been laid down so as to ensure economical working in every department.

A drive through Milton village to the South Parade, and "high tea" at the Esplanade Hotel, terminated what was agreed on all hands had been a most successful gathering.

In the course of the day, Mr. Ashworth gave some interesting particulars as to the extension of the Company's business during the last nine years. In this time, the capital has risen from £204,328 to £472,839; equivalent to £2 16s. 1d. rising to £3 13s. 1d. per ton of coal carbonized. The gas sold during the same period has increased from 735 million cubic feet to 1294 millions; the maximum daily supply having advanced from 3,134,000 to 4,972,000 cubic feet. The Company's total number of consumers at present is 35,750, contrasted with 12,459 in 1898; and there has been an even greater proportionate increase in the quantity of stoves hired out by the Company—the figures advancing from 4833 in 1898 to no less than 25,003 at June 30 of this year.

Engineering at the British Association Meeting.

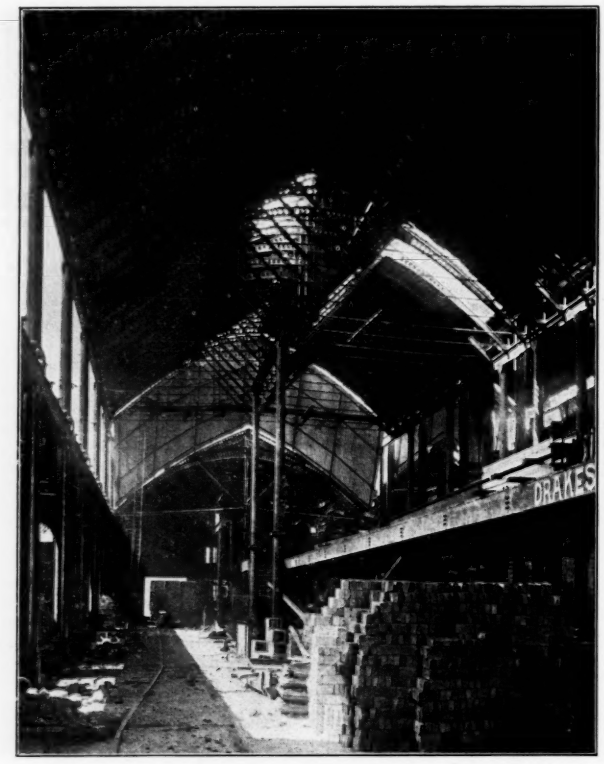
The provisional programme for the forthcoming meeting of the British Association in York presents several interesting features in the Engineering Section, of which Professor Ewing is President. Sir John Wolfe-Barry will have a paper on "Standardization in British Engineering Practice;" Messrs. S. H. Davies and F. G. Fryer will deal with "The Removal of Dust and Smoke from Chimney Gases;" Professor W. E. Dalby will present "Some Recent Experimental Results with Internal Combustion Engines;" Mr. A. J. Martin will bring forward again his scheme for affording a supply of gas for light, heat, and power; and Mr. D. Mackenzie will introduce the subject of waterproofing roads as a solution of the dust problem.

JUNIOR INSTITUTION OF ENGINEERS AT SOUTHPORT.

THE Junior Institution of Engineers opened its Summer Meeting on Saturday, the 14th inst. This year the Manchester district was visited, with headquarters at Southport. Assembling in the Mayor's Parlour of the Southport Town Hall, the members, and the ladies accompanying them, were welcomed by the Ex-Mayor (Mr. Councillor Trounson), with whom were the Town Clerk (Mr. Jarratt), the Borough Gas and Electrical Engineers (Mr. John Bond and Mr. R. S. Downe respectively), and the Tramways Manager (Mr. T. J. Kendrew).

On behalf of the Corporation, Mr. Trounson expressed the pleasure they felt in receiving the Institution, and the assurance that anything they could do to enhance the interest and enjoyment of their visitors' sojourn at Southport would afford them much satisfaction. In cordially acknowledging these words of welcome, Mr. W. J. Tennant, a Past Chairman, referred to the enterprising spirit which had characterized the history of the borough, and to the great success which had attended the efforts of the Municipality in developing the town to its present attractive and prosperous condition.

After having partaken of refreshments, the party were shown



Old Retort-House, showing the Height the Roof has been Raised.

over the various apartments of the municipal buildings, and were then conveyed by the Corporation tramway to Crowlands, to inspect the Gas and Electricity works, and the Tramway depôt, under the able guidance of the respective Managers—Mr. R. Walmsley assisting at the gas-works.

Notes on the Gas Supply and Alterations and Extensions at the Works.

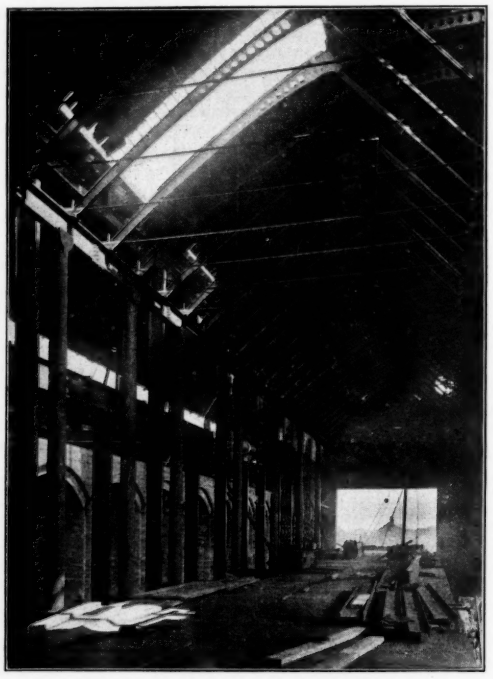
The works are situated at Crowlands; and the estate has an area of about 12 acres. The gas plant is capable of manufacturing 3,500,000 cubic feet of gas per day; and there is also in connection with the works, plant for the manufacture of sulphate of ammonia and for the distillation of coal tar.

The Corporation have power to supply gas to all places within a radius of 6 miles from the Town Hall, and at the present time are supplying gas to Birkdale, Ainsdale, Banks, and Crossens. Gas is supplied in Southport at 2s. 8d. per 1000 cubic feet, with a discount of 5 per cent. if the quarterly account is paid within one month. For power purposes, gas is supplied at the following rates: For a consumption of 1,000,000 cubic feet, or over, 2s. per 1000 cubic feet; for a consumption of 500,000 cubic feet to 1,000,000 cubic feet, 2s. 2d. per 1000 cubic feet; for a consumption of 250,000 cubic feet to 500,000 cubic feet, 2s. 4d. per 1000 cubic feet; for a consumption less than 250,000 cubic feet, 2s. 6d. per 1000 cubic feet—the prices being subject to discount of 5 per cent. if the quarterly account is paid within a month.

The total make of gas for the year ending March 31, 1906, was 485,315,000 cubic feet; and the gas sold amounted to 474,095,000 cubic feet. There was an increase in sales of gas of 3·8 per cent. over the corresponding year. The production of coke was 17,516 tons; of breeze, 2412 tons; of tar, 2450 tons; and of sulphate of ammonia, 347 tons.

The total capital expended on the undertaking amounts to £283,405; and the capital now on mortgage is £206,085.

Some considerable changes are being made at the works. Among the heavier work, it is noticed that rather more than half

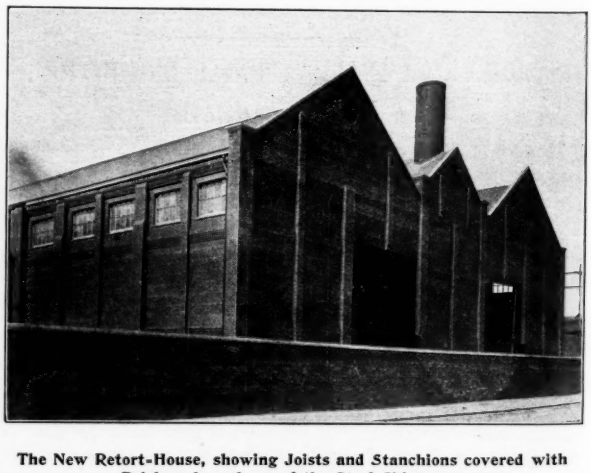


View on the Stage Floor of the House.

the old retort-house roof has been raised 13 ft. 6 in., and that portion of the house prepared for the erection of eleven settings of eight through retorts on the regenerative principle. There is a small roof above the retort-settings having a span of 21 ft. 4 in. and two larger roofs at either side having a span of 49 ft. 4 in. each. The roof principals are made of cast iron; and it is interesting to note that, although these were erected over twenty years ago, they are to-day almost as good as new.

Four additional retort-settings have been constructed in a new buiding adjoining the old retort-house. This new structure is built on rolled steel joists, having panelling 9 inches thick. By adopting this method, a large amount of money was saved in foundation work, as it is necessary on this site to excavate to the depth of 15 feet. The whole of the joists and stanchions are covered with brickwork, so that none of the steel framing of the building shows.

In front of the retort-bench, and on either side, there is a stage



The New Retort-House, showing Joists and Stanchions covered with Brickwork, and one of the Steel Chimneys.

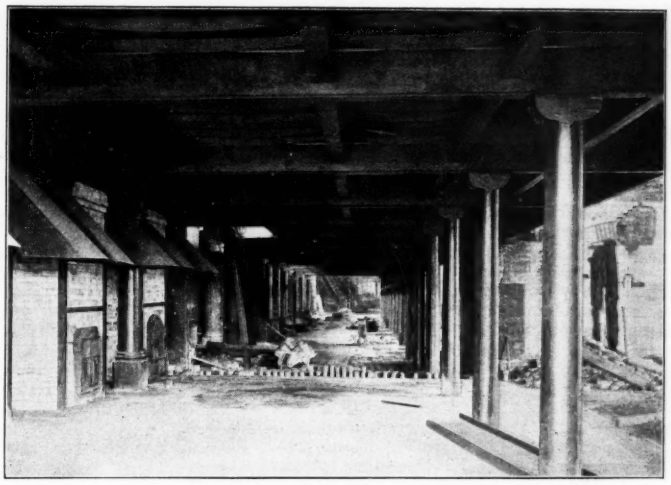
flooring 11 ft. 6 in. above the ground line, and 25 feet wide. Connected to the main flue of the settings are two steel chimneys, lined with 9-inch fire-bricks. These chimneys are 64 feet high from the ground level, and 4 ft. 6 in. internal diameter.

The new retorts are 20 feet through, and have a section of 22 inches by 16 inches. These will be drawn and charged by West's Gas Improvement Company's compressed-air stoking machinery. The coal will be placed in the retorts by the West new twin-scoop charger.

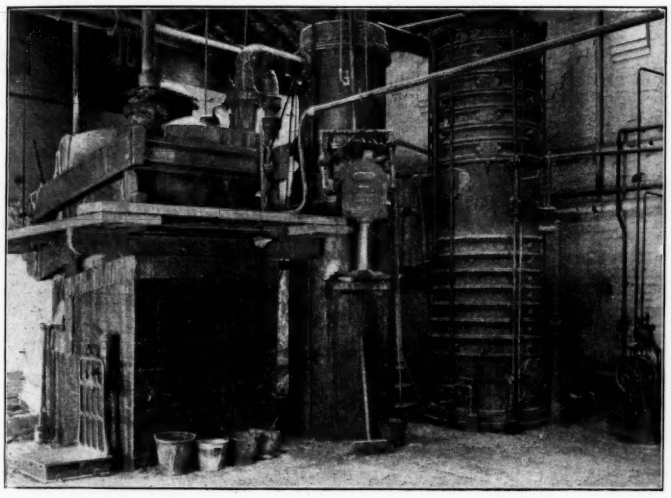
The whole of the coal carbonized at the works is brought in from the Blowick siding, tipped into breakers, and then elevated into hoppers fixed above the West stoking machinery.

In connection with the manufacture of gas, there are three complete sets of carburetted water-gas apparatus, each capable of making 500,000 cubic feet of gas per day. The blowers are driven by 30-horse power De Laval turbines and work at 1800 revolutions per minute. Close to the water-gas plant is the coke-elevator which lifts the coke to the storage hoppers, capable of storing 100 tons of coke. Four boilers supply steam to different engines and plant on the works, two of which work at a pressure of 110 lbs., and two at 100 lbs. pressure per square inch.

There is one set of condensers for the coal gas,



View Beneath the Stage Floor.



Sulphate of Ammonia Plant.

capable of dealing with 2½ million cubic feet of gas per day. Also in connection with the coal-gas plant, are two tower scrubbers and one rotary washer, four purifiers, and two catch boxes. The whole of the gas is purified by means of oxide of iron. Regarding the gasholders, two have a capacity of 300,000 cubic feet, and one of 1,250,000 cubic feet. The gas is governed by Cowan's patent governors, and passed on to the town by a 42-inch trunk main.

During the members' tour of the works, the ladies of the party were kindly entertained by Mrs. Bond, and luncheon followed.

The visitors were evidently much impressed by all they saw—at the gas-works particularly, in the departments in which Mr. Bond demonstrated with the various instruments and apparatus described in the paper which he read last year before the Institution of Gas Engineers, on "Pyrometers and Carbonization."

Hearty thanks for all the kindness and hospitality which Mr. Bond had displayed were conveyed by the Chairman of the Junior Institution (Mr. Adam Hunter), and were suitably acknowledged.

On Monday a visit was paid to Manchester; on Wednesday, to Ashton-under-Lyne; on Thursday, to Wigan. It was an altogether enjoyable time; and for the arrangements made for the comfort of the members, thanks are largely due to their Secretary (Mr. Walter T. Dunn).

MODERN INVENTIONS AND ANCIENT DRESS.

A Gala Day at Ilford.

Saturday, the 14th inst., was Hospital Day at Ilford; and right well a large number of Ilfordians set to work to make the day a grand success for their hospital. They stirred up interest by organizing a procession and carnival; and in the procession gas had its representatives. The illustration is a reproduction from a photograph of one of two cars taken in the Ilford Gas Company's yard; the subject being "Lighting and Heating by Gas." The other car represented "Cooking by Gas." The cars were arranged by the Ilford Gas Company, in conjunction with the Richmond Gas Stove and Meter Company, Limited. The suggestion may be useful.

"Soils and Subsoils from a Sanitary Point of View."—The Board of Agriculture and Fisheries have just published a memoir of the Geological Survey on this subject, dealing specially with the soils and subsoils of London and its environs with reference to sites for houses. Questions of water supply, ground water, and drainage are, however, also discussed in their sanitary aspects; and there is an interesting chapter on London Water Supply and rural water supplies and sanitation. The work, which is by Mr. Horace B. Woodward, F.R.S., was originally issued in 1897; and in preparing the present edition no change has been made in the method of dealing with the subject, but new matter has been introduced and the whole carefully revised. The geology of the district is described according to the nature of the subsoil, whether clayey, sandy, gravelly, or chalky. A small colour-printed map accompanies the letterpress; and the memoir is further illustrated by 22 sections and drawings. At the end is a full index, in which the heights of all places marked on the map or referred to in the text are given. Copies may be obtained from the Ordnance Survey Office, Southampton, at the price of 1s. 6d.

GERMAN ASSOCIATION OF GAS AND WATER ENGINEERS—REPORTS OF COMMISSIONS.*

IV.—Heating Commission.

As already mentioned in our correspondent's account of the proceedings at the last meeting of the German Association of Gas and Water Engineers, the report presented by the Commission on Heating deals with three matters—indirect lighting by means of gas; Privy Councillor Rietschel's original proposals for the regulation of gas-heating apparatus; and the use of coke in the furnaces of appliances intended to supply heat from some central spot.

Referring to the indirect lighting of schools, &c., by means of gas, the Commission states that some 1400 copies of the original report of the investigations carried out at Munich in 1904 have been printed and distributed among local and municipal authorities, governors of high schools, and the editors of technical and daily papers. To the newspapers, a circular note was also sent, calling attention to the more important results of the inquiry. Thus everything possible has been done to increase the knowledge of the public, and to combat the erroneous notion that the illumination of schools and similar large buildings can only be considered efficient and "up-to-date" if the source of light is the electric current. At the same time, members of the Commission think the officials of provincial gas-works might well assist in this work by bringing the advantages of gas as a hygienic illuminant to the notice of school proprietors, more especially when the schools are under the control of the local municipalities.

The reference made by the Commissioners to Professor Rietschel's suggestions for the construction of gas-stoves and fires calls for no further notice in our columns, as the present position of the matter was fully explained in the "JOURNAL" for March 20, p. 785. A code of regulations for the selection and erection of heating apparatus is now being drawn up by the Commission, in collaboration with Dr. Rietschel.

The Heating Commission of the Association has taken over an inquiry instituted first by the Middle Rhenish Association of Gas and Water Engineers, the object of which was to ascertain the opinions held by makers of certain forms of large heating apparatus as to the value of gas coke in comparison with other forms of fuel. The type of apparatus in view is that employed to heat the whole or part of a large building from one single combustion furnace—*i.e.*, the so-called central station or central point heating apparatus. In pursuance of this aim, the Commission addressed a long set of questions to all members of the German Association of Central Heating Engineers, collecting the replies into a voluminous table appended to the general report.

Replies were received from 80 firms constructing appliances of the kind mentioned. Three of the firms consider gas coke to be unsuitable for combustion in their furnaces; 24 consider it suitable, provided it answers certain requirements as to quality; 44 regard it as undoubtedly equal in value to metallurgical coke; and 9 state that gas coke is as good as, if not better than, foundry coke. The chief qualities demanded from a coke are that it shall yield but little ash and slaty matter; that it shall form the smallest possible quantity of clinker; that it shall be well screened and of suitable size (1 to 3 inch lumps, according to the size of the furnace), free from dust, fine particles, and foreign matter; that it shall be as hard as possible; and that it shall be stored in a dry place. Many of the firms complain that gas coke of the same nominal kind varies a good deal in quality. As far as can be judged from the replies, gas coke varies very considerably in its suitability for combustion in these central heating furnaces according to the coal from which it is made. Gas coke from English coal is nearly always favourably spoken of. Coke from Ruhr coal is generally praised, particularly for the little clinker and the loose powdery ash it leaves behind. The reports upon Silesian gas coke are similar. Opinions differ in respect of Saar coke. It is frequently said to leave much clinker. Cokes from Saxon and Bohemian coals are mostly regarded unfavourably; complaints being made that they produce a large amount of clinker having a vitreous nature, that they vary in quality, and that they attack the furnace plates. A few firms recommend an addition of brown coal or of ordinary bituminous coal to Saxon coke in order to render it better suited for employment in the furnaces.

Many of the furnace makers say that, if the apparatus is to consume gas coke, it must be fitted with a larger charging hopper and a more extensive grate area than are necessary for oven coke; and a few remark that convenient arrangements for clinkering the fire are specially desirable. Most makers recommend cast-iron furnaces and water-cooled grates for coke firing, and especially for gas coke; but many state that water cooling is not necessary if the coke is good. Nearly all the firms claim that gas coke can be used in their apparatus without involving any alteration—all that is requisite being more frequent and more careful stoking.

* No. III. of this series of reports is held over for awhile. It is that by Dr. Haber, on "Electrolysis at Karlsruhe," and was supplementary to the report of the Electrolysis Commission, as given in last week's issue of the "JOURNAL," pp. 164-65.

V.—Gas-Meter Commission.

The report of the Gas-Meter Commission this year deals once again with the substitutes for leather which are used in constructing the measuring drums of dry gas-meters. The substance employed consists of a textile fabric like cotton coated with a preparation of linseed oil; and the report describes at some length the manner in which linseed oil, other drying oils, and oil varnishes behave when exposed to air. It does not appear that any of these substances are used for the impregnation of the cotton fabric, except linseed oil itself; but the oil is often prepared by "boiling" it with some drier or siccative.

Fresh linseed oil is easily soluble in the ordinary fat solvents, such as ether, petroleum spirit of various grades, benzene, chloroform, and carbon bisulphide. It also dissolves in 40 parts of cold or in 5 parts of boiling alcohol. When exposed to air, it dries gradually; being converted into what Mulder has termed "linoxyn,"—a body of unknown constitution, which forms an elastic skin, insoluble in hot alcohol, but softened and finally dissolved by a mixture of alcohol and chloroform. After exposure for about three weeks, the thin skin of dry linseed oil on a glass plate has been found by Dr. Fischer to be practically insoluble in boiling benzene and in boiling alcohol. Fresh and imperfectly dry linseed oil absorbs the heavy hydrocarbons of coal gas; but when the raw or boiled oil has dried thoroughly, it loses its power of absorption.

It follows from the above statement, and from some experiments described on a former occasion, that if the diaphragms of a dry meter consist of cotton fabric coated with linseed oil which has not dried thoroughly, the diaphragms are injured by the gas passing through the meter, especially if the gas has been enriched with benzol or xylol; and the rapidity with which they become useless and leaky increases as the oil film contains the more unoxidized linseed oil—*i.e.*, as the membranes have been given the less time to dry before being taken into use. Hence it becomes desirable to possess some method for ascertaining the extent of the oxidation that has taken place.

Dr. Leybold suggests that a weighed piece of the material shall be (1) extracted with hot benzene—the extract being dried at 100° C. and weighed; (2) the residue boiled with alcohol till free from oil, and the extract dried and weighed as before; (3) the residual material dried at 100° C. and weighed. In this fashion are obtained (1) the weight of unoxidized oil; (2) the weight of dried oil; (3) the weight of the fabric. Other samples of the material are exposed freely to air, and examined every 14 days until the results no longer differ seriously.

In order that some standard process may be elaborated for testing these textile membranes, consultations have been held between the members of the Gas-Meter Commission and the Government Stamping Department. The present idea is to extract a membrane in some specified apparatus, such as a Soxhlet, with a solvent of prescribed composition—*e.g.*, a mixture of dry ether and carbon tetrachloride. But the matter has not yet reached such a stage that publication of the results is possible. It is hoped, however, that the necessary arrangements will be concluded before the next meeting of the Association. In the meantime, it may be mentioned that the Stamping Department carried out an experiment with one of these fabric diaphragms last autumn; finding that the proportion of "linoxyn" rose during about four weeks from 65 to 74 per cent., the proportion of unoxidized oil falling from 35 to 26 per cent.

All that has been said hitherto relates to membranes prepared with linseed oil only. A short time ago a firm at Karlsruhe made some attempts to construct diaphragms for dry gas-meters of cotton fabric impregnated with an oil varnish—sending a few samples for examination to the local gas-works and to the Stamping Department. The varnish was apparently composed of waste amber dissolved in turpentine and linseed oil. The film was readily soluble in carbon tetrachloride. On rubbing the membrane with the fingers, the resin came away as powder; so that the preparation is useless for the purpose in view.

Rumours were current in the early part of 1905 that a new measure to be introduced into the Reichstag might include a clause stipulating for the periodical re-stamping of gas-meters; but before the House rose in May, it was evident that no such regulation was contemplated. A communication on the subject has been made to the President by the Association; but up to the time of drawing up the present report, nothing further has been heard of the Bill.

VI.—Training Commission.

The report of the Training Commission is taken up with an account—prepared by Herr Windeck, of Cologne—of the new arrangements recently concluded for holding technical classes in the subjects of gas, water, and electrical engineering in the parts of Germany represented by the Rhineland and Westphalian Association of Gas and Water Engineers. The scheme was elaborated in collaboration with the Associated Royal Schools of Machine Design, at a conference held last summer in Cologne, under the presidency of Privy Councillor Dönhoff, from the Ministry of Commerce at Berlin; and it has since been approved by that Government Department.

The classes are supervised by the State, and are held in conjunction with the Associated Royal Schools of Machine Design. They are open to persons between 24 and 40 years of age who

have fulfilled their military duties. Men who desire to take the fitters' course must show that they have served a certain length of time as apprentice to a fitter, tinsmith, coppersmith, or working engineer; although a few students may be admitted who have attended other classes on similar subjects in Prussia. Men who desire to take the gas makers' class must have served as masons or fitters in gas-works, or in the construction or rebuilding of works. The classes last three months; the first four weeks being devoted to a general course of instruction which is alike for all students, and the final eight weeks being spent upon specialized studies. The general course of 48 hours per week comprises ordinary school subjects, a little physics and chemistry, technical free-hand and geometrical drawing, law, and "first-aid." After this course has been completed, the student takes one of three subsequent courses according as he desires to qualify as a gas and water fitter, as an electric fitter, or as a gas maker. In the gas and water fitters' class, the student spends sixteen hours per week in practical work, erecting apparatus for lighting and heating by gas, baths, closets, lavatories, &c. He devotes twelve hours to drawing, preparing plans of buildings and the gas and water fittings required in them; and the remaining twenty hours per week he devotes to lectures. The finishing course for gas makers is taken up with sixteen hours' work on two days per week in the gas-works at Cologne and the neighbourhood, and in participating in the laying of mains and smaller pipes; ten hours he devotes to lectures on the management of plant and apparatus and the construction of furnaces; while the remaining twelve hours are divided between chemistry, physics, street lighting, book-keeping, and drawing. The final electrical course is split up in a similar manner; four hours being spent per week in laboratory practice, and twelve hours in practical work outside.

The fees for each complete course are 75 marks (about £3 15s.). At the close, an examination is held; the presiding examiner being the teacher.

VII.—Water Statistics Commission.

The report of the Water Statistics Commission mentions that the usual set of questions was sent out for the seventeenth time during the past year; the number of works applied to being 365. At the date of writing, replies had been received from 290; and 55 answers had come to hand relating to the previous year. The replies are now being collated; and it is hoped that the final tables will be ready shortly. The figures which have been received show that the amount of work done by the pumping machinery per unit weight of fuel continues to increase each year, not only in the larger water-works, but in the small places also. The Commission regards this as a most gratifying feature of the returns, and considers that its own labours in collecting and publishing the various particulars contained in its annual tables have assisted in the advance.

ANOTHER FLICKER PHOTOMETER.

Some types of flicker photometer devised on the Continent were described in the "Journal" earlier this year,* and one emanating from this country now calls for notice. It is the invention of Mr. Lancelot W. Wild, who has described it in the last issue of the "Electrician." He first discusses the errors incidental to other modes of photometry with special reference to the flicker principle, and then proceeds to show how he avoids the chief sources of error by means of his new device.

The errors to which he more particularly refers are those of angularity, which, as is well known, may be very serious, especially with the wedge type of screen, and with lights such as electric glow lamps, of which the centre of the field from which the light emanates is not easy to locate. He defines the art of photometry broadly as consisting in judging the illumination of two contiguous surfaces, each of which is lighted from a separate source, and the ideal screen (which is never realized in practice) as one that appears to be equally illuminated at any angle of view, while the illumination is exactly proportional to the cosine of the angle from the perpendicular at which the light-rays strike the surface of the screen. In order to ascertain the magnitude of the error due to the variation of the apparent illumination of a screen with the angle of view, Mr. Wild made observations with a bunsen disc set up between two lights, one of which was moved until a balance was obtained—the disc being viewed at different angles in turn. For the screen in question, it appears from the results of these observations that the best angle of view is about 50° to 60°; and it seems preferable in precise photometry to choose some such angle.

Mr. Wild goes on to discuss the wedge pattern screen, and shows how the Ritchie or other wedge which stands upright upon the triangular base is liable to induce serious errors in observation, if there is any appreciable horizontal side-play in the mounting of the screen or its carriage. If, as is common with such wedge screens, the rays strike the surface at an angle of 60°, then if the play of the carriage admits of it being displaced 1° horizontally, the illumination of one surface will be increased by 3 per cent., and that of the other reduced by 3 per cent.; so that the total error will be 6 per cent. As such a displacement of the carriage is by no means abnormal with photometers, the error involved thereby may commonly amount to 6 per cent. and more. The Simmance-Abady photometer avoids this source of error, because the wedge is placed with the apex of the triangle upwards. But even with it, if the carriage does not travel truly, or if the bar is not straight, error is introduced. With the tilting form of this photometer, an error of 1° in the setting of the tilting-scale, which may occur by inadvertence, will cause an error of 5 per cent. in the measurement. If the photometric screen is of a pattern in which the surfaces are parallel and perpendicular to the rays of light, tilting of the carriage is of no moment. The Ritchie or other up-ended wedge when set 30 inches from one of the lights will have an error of 3 per cent. if the light is displaced horizontally by ½ inch, which diplacement causes the rays to impinge upon the screen at 59° or 61°, instead of 60°. If both lights are out of line to this extent, the total error may attain 6 per cent. Vertical displacements of like degree may cause 5 per cent. error with the Simmance-Abady photometer.

Such displacements inadvertently occur in setting up electric glow lamps with irregular filaments. With screens, however, which are struck perpendicularly by the rays, a small want of alignment is of no moment. Simmance-Abady and Whitman types of flicker photometer suffer on account of their angularity errors; and personally Mr. Wild would prefer to use a simple bunsen disc for comparing lights differing in colour even as greatly as a Welsbach light and a flame arc lamp. But as a flicker photometer is frequently desirable, he has devised one which, as far as may be, embodies principles which he sets forth as essential to the avoidance of angularity errors—viz., the use of parallel screen surfaces, both perpendicular to the light-rays and viewed through a tube so that the angle of view is fixed.

He employs a disc of the pattern shown in the annexed diagram (fig. 1), cut out of blotting-paper, and treated as to one half with paraffin wax, so that half the disc is translucent and diffusing and the other half opaque and reflecting. This disc is rotated about its centre by means of a small electric motor; and a telescope is used to view in a mirror the image of a small portion of the upper part of the rotating disc. The effect of the telescope is to focus the eye upon the image of this portion of the disc, with the result that great sensitiveness is secured, and the eye is less fatigued. With this arrangement, which is shown in fig. 2, no angularity error was detected by Mr. Wild, even when the photometer was tilted 10 per cent. out of truth, or when the lights were as much as 6 inches away from the axial line.

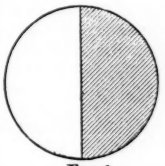


Fig. 1

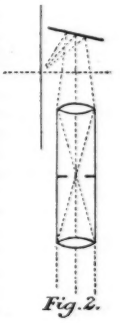


Fig. 2.

A Combination Gas-Tap.

In our "Register of Patents" to-day, there will be found particulars of a gas-tap invented by Mr. F. Ainsworth, of the Ilford Gas Company, who claims that the use of this appliance obviates noise from gas-fires, whatever the pressure may be; and that it saves from 10 to 25 per cent. in consumption, according to circumstances. There is no leather, no rubber, no loose parts, no leakage, no stoppage by rust, &c.—in fact, nothing to get out of order. It is adjustable from the outside, fixed like any other tap, very simple to manipulate, and can be adjusted for any pressure by the most inexperienced person. Mr. Ainsworth calls his invention the "Two-in-One" tap; and he maintains that where it is used, the gas-fire will stand greater variation of pressure without firing-back than with any other tap on the market. With a view to proving this, a series of experiments were made, using a test-holder and a 10-inch gas-fire; the tap being adjusted to pass 20 cubic feet of gas per hour at the higher pressure in each case. An initial holder pressure of 70-10ths was reduced to 18-10ths, 60-10ths to 14-10ths, 50-10ths to 10-10ths, 40-10ths to 8-10ths, and 30-10ths to 6-10ths. In no case did lighting-back take place at the lower pressure, though no adjustment of the tap was made. In addition to its simplicity and durability, an advantage of the "Two-in-One" is said to be that it costs very little more than any other well-made tap.

His Majesty the King has been pleased to confer the honour of knighthood upon Dr. W. H. Perkin, F.R.S., the originator of the coal-tar colour industry. The celebration of the jubilee of Dr. Perkin's discovery will take place in London this week, as already announced.

We are pleased to notice two recent instances of the recognition of members of the gas and water engineering professions as qualified to serve on the Commission of the Peace. Mr. Thomas Brace, the Manager of the Monmouth Gas and Water Company, has been made a Magistrate of the borough of Monmouth; and Mr. James Diggle, Assoc.M.Inst.C.E., the Engineer of the Heywood and Middleton Water Board and of the Bacup Water-Works, has been invited by the Chancellor of the Duchy of Lancaster to take a seat on the County Bench.

* See "Journal," Vol. XCIV., p. 643.

THE RELATIVE VALUE OF RADIATED AND CONDUCTED HEAT IN CARBONIZATION.

By Thomas Holgate.

The subject honoured by the Institution of Gas Engineers at their recent meeting by being placed at the head of the technical communications, was that of the carbonization of coal in vertical retorts. But while the importance will be readily accepted, one may be permitted to doubt whether any considerable accession of new facts was brought to light on that occasion. In the strictest view, of course, this last *desideratum* can only be said to be attained when working results over a period can be produced; but inasmuch as this degree of perfection can be reached only after much patient labour upon the part of technical experimentalists, one must often be content to accept fragmentary information, and be thankful (as I am personally) for it until further progress has been realized.

In the case of one of the papers upon this subject, there could obviously be no demonstration from practical working as to the value of the system brought forward for exposition and impartial friendly criticism. The very nature of the case precluded any discussion other than of the principles enunciated or implied. If, therefore, I now discuss one part of Mr. Thomas Glover's communication, it is with the object, in a perfectly friendly way, of attempting to separate what appears to be the "wheat" from the "chaff;" the "wheat" possibly being a symbol for the practical conception, and the "chaff" a symbol of a theoretical basis or explanation that lacks justification. At any rate, I am in complete accord with Mr. Glover in desiring a correct understanding of the subject; for, in his own words, one object of the paper was "to consider the fundamental truths underlying the process." It is evident from the paper that the effect of radiant heat is one of the truths regarded by him as fundamental. That it is anything more than academic, I think he has failed to show. He has told of the varied rate of absorption of radiated heat by various simple and compound gases; but he has given no quantitative statement of what this amounts to, much less a comparison as to its magnitude relative to the heat transmitted by conduction and convection.

The experiments of Professor Tyndall were made to ascertain one factor in heat transmission, under carefully defined conditions—one being that the vessel containing the gas itself was not heated, and another that mixtures of gases were not allowed to impart heat (by commingling) to their several constituents. Both these conditions are diametrically opposed to those existing in a heated retort in which coal is being gasified and carbonized. Still, it must be admitted that the laws of radiation of heat through gases—measured by Tyndall under ideal conditions—must operate even inside a retort. But the practical question arises, Is its effect not at once overwhelmed by the greater quantity of heat transferred by contact with the walls of the retort and the hot coal, and by convection of the gases? Mr. Glover refers us to Mr. Young's exposition of the applicability of Tyndall's researches, which may be found in the "Journal," Vol. XXXII., p. 716, and bases on it a plea for a free space above the coal in a horizontal retort; and from thence he argues for a similar space in a vertical retort. A reference to that source, shows that Mr. Young does not forget to mention the heat conducted; but again the relative magnitude of the two agencies and their practical inseparability are not dealt with. Upon the merely theoretical side, a communicated article entitled "Diathermancy," by Mr. Enoch Evans, which appeared in the "Journal," Vol. XLIV., p. 893, may profitably be consulted; for he shows that the enormous velocities of the various gases (on the basis of the Kinetic theory) provide that the temperature of the several components must speedily become that of the retort surface, independent of the degree of molecular complexity.

Mr. Glover says two points were made clear by Mr. Young—viz., "the selective action of radiant heat on hydrocarbon vapour and gases, and the indiscriminate action of contact heat in splitting up valuable hydrocarbons into carbon and gases of low illuminating value. Contact heat, be it observed, exercises its destructive action as the gases are distilled from the heart of a thick charge, and find their way to the free space through a casing of incandescent coke." I must confess to being unable to clearly apprehend the meaning of the foregoing quotation. If the value of radiant heat absorption is numerically greatest in the case of the higher hydrocarbons, and since it is feared that excessive heat will split up these same hydrocarbons, then why is it to be recommended in preference to contact heat? The contact heat available is that of: (*a*) the retort surface, (*b*) the heated coal, and (*c*) the hot gases. Of necessity, the two last cannot at any time be at a higher temperature than the first named; and during a large part of the period of distillation the coal must be at a lower temperature than the retort surface. How then can the contact-heat be more injurious than the radiant heat, seeing that the temperature of the former is governed by that of the retort surface from which the primary radiation proceeds?

When, however, one follows Mr. Glover's suggestion and studies Mr. Young's own words (see "Journal," Vol. XXXII., p. 717), the office of radiant heat is found to be explained in a somewhat different way. Mr. Young there says: "Now, the radiant heat, although inert in so far as the simpler compounds are concerned, is not so in the case of those complex compounds, some of which—such as the higher paraffins—contain upwards of 50 atoms in their molecules. These complex molecules respond to the ether waves of radiant heat from the walls of the retort, or, so to speak, absorb them; their motion being thereby so accelerated that they are shaken to pieces, or decomposed into simpler compounds. Whereas when the retort is fully charged and no free space is allowed, the decomposition must be brought about almost entirely by contact between the heated molecules and the molecules of the gases and vapours." The meaning is here more clearly seen; but there is found, neither in this quotation nor in the other parts of Mr. Young's paper dealing with this topic, anything partaking of the nature of demonstration as distinct from speculation.

Mr. Young makes no claim to demonstration; and in the absence of figures showing the temperature required and the amount of heat needed to be put into highly complex hydrocarbons to secure their dissociation, one must regard the proposition as calling for a suspended judgment. It involves the assumption that the radiant heat will be suited to the gasification of heavy vapour without injury to the valuable hydrocarbon gases existing at the same time in the retort; and also that there will be a differentiating effect in temperature and quantity of heat in favour of certain vapours as against others. Such an assumption I believe to be untenable; for the whole of the gases and vapours must be approximately at the same temperature in the presence of such highly heated surfaces; and by virtue of the rapid movement of their molecules. In other words, I cannot conceive that any other question arises—under the given conditions—than quantity and intensity of heat, irrespective of whether these are imparted by contact or radiation.

Upon the practical side, it may be asked what proof have we of better carbonizing results when the space over the same thickness and weight of coal is large compared with those obtained when the space is small. If the results hitherto published of carbonizing coal in vertical retorts, intermittently charged, and where the free space is small or *nil*, be compared with those of the same coal carbonized in horizontal retorts, I believe it will be found that there is no falling off by the newer practice.

It is of the utmost importance, in the discussion of such a complicated process as the distillation of coal, that no axiom should be introduced that has not survived scrutiny. If there is proof available that under certain conditions radiant heat will do something that heat by conduction and convection fails to do, and that such conditions admit of practical application, then it is desirable that it should be forthcoming. The nearest approach to such evidence would doubtless be found in the large diameter retorts used in the manufacture of oil gas on the Peebles system. The admirable results, both in quantity and quality of gas obtained thereby, cannot, however, be at once placed to the credit of radiant heat as contrasted with conducted and convected heat; for the employment of low temperatures with a return of the non-permanent vapours were elements that were at least of equal importance. The parallelism between the carbonization of oil and that of coal is not so complete that results can be predicated of the latter from the former, without the confirmation of actual tests. No statement as to the value of the free space over a charge of coal would appear to be satisfactory that is not supported by tests made under conditions that do not introduce other disturbing factors.

Now that charging is done by projectors and discharging by rams, it ought to be possible on the working scale to ascertain the results when there is a small free space *versus* a large free space; but the shape of the retort, the weight of charge, its duration, and the temperature would need carefully defining, in order to obtain results of practical value. The evolution of the vertical retort need not, however, wait for this enlightenment drawn from horizontals; for the practical issue of the problem is well worthy of experiments upon the vertical retort itself, and that without delay. When this has been done, one will be able to answer with more certainty the question here touched upon, and others that arise out of this important subject. Meanwhile, our gratitude is due to the pioneers who are discovering for us the real value of the distillation of coal in vertical retorts, and among these Mr. William Young and Messrs. Samuel and Thomas Glover must hold an honoured place.

THE UTILIZATION OF ATMOSPHERIC NITROGEN.

ITS INFLUENCE ON SULPHATE OF AMMONIA SALES.

By H. Leicester Greville, F.I.C., F.C.S.

The utilization of atmospheric nitrogen has been a problem which has exercised the minds of scientific men for a great number of years, but has more recently received increased attention as the magnitude of the issues dependent upon the solution of so difficult a problem has become more manifest. Scientific research, both in the domain of physics and of chemistry, is increasingly tending to the economic utilization of undeveloped natural energies, and of the bye-products of manufacturing industries. The particular problem of the utilization of atmospheric nitrogen has more interest to gas companies than they are

possibly aware of from a casual perusal of recent research. Sulphate of ammonia is a bye-product from the gas industry realizing a really appreciable amount; and as a manure it has only one competitor on the market—viz., nitrate of soda, mainly procured as a native product from Chili.

Free nitrogen cannot be assimilated by plant life, but only in combination with oxygen and hydrogen. In the former state, we have the commercial product of nitrate of soda; and in the latter state, that of sulphate of ammonia. In the atmosphere, we have an unlimited supply of nitrogen. If the problem were solved, of combining this element with oxygen or hydrogen (so as to be available for assimilation by plant life), and this could be accomplished economically, a vast impetus would be given to Science, but a disastrous blow to gas manufacture and allied industries.

With regard to sulphate of ammonia, it is an unfortunate fact that only a very small proportion of the nitrogen existing in the original coal is recovered in the saleable product of sulphate of ammonia. From some unexplained reason, a large proportion of the nitrogen in the original coal remains in the coke. This was proved by the late Professor Foster's researches. Of the proportion of nitrogen in the usual process of carbonization taking the form of ammonia, there is no doubt that a part is decomposed at the high temperature of the retorts used in the carbonization of the coal. It has been proved that ammonia in contact with chemically neutral bodies at high temperature, is subject to rapid dissociation. This condition is quite unavoidable under the modern conditions of gas manufacture—more especially where the highest heat is used with the greatest production of gas, which is a condition favoured by the lowering of the parliamentary standard of illuminating power.

The question of the dissociation of ammonia into its elements at high temperatures, is an unfortunate condition in the manufacture of water gas. Theoretically, the nitrogen in the coke used in contact with steam should form ammonia. No doubt this reaction occurs; but the ammonia formed is subsequently decomposed, with the result that the condensed liquor from the water-gas plant contains practically no ammonia.

I have proved experimentally that, at a comparatively low temperature, the whole of the nitrogen in coke can be converted into ammonia by the action of steam, and with the theoretical production of carbon monoxide and hydrogen. The conditions of the experiment would not, however, be available for commercial purposes. The nearest approach to the utilization of the nitrogen in coal has been made in the process of the manufacture of gas by the "Mond" system. This arises from the lower temperature employed. But the economy of the whole process of gas manufacture is not a pure question of the recovery of bye-products.

The discovery of the possible reaction at high temperature realizable by the employment of electricity has revolutionized many preconceived ideas—among others, that of the combination of nitrogen and oxygen. A most important paper was recently read before the London Section of the Society of Chemical Industry, by Professor Philippe a'Guye, on "The Electro-Chemical Problem of the Fixation of Nitrogen." The title of the paper indicates the lines of argument and research. The fixation of nitrogen, as far as our present knowledge can determine, is only possible under special conditions in which the main function is the necessity for the employment of a very high temperature—so high, in fact, that nothing short of electricity can be used. This being admitted, the question, *cæteris paribus*, becomes one of the cheapest method of obtaining electricity. For the special purpose under consideration, nothing short of the use of the forces of Nature need possibly require comment. At the same time, there is a very strong argument in favour of a peculiar combination of management in a different direction.

Coal treated on the Mond gas system yields a large proportion of its total nitrogen as ammonia, and a large volume of a low-grade gas, produceable at a very cheap rate and available for power purposes. This enables electrical energy to be produced at a comparatively low price. This electrical energy can be utilized for the fixation of atmospheric nitrogen, or can be used for other purposes. The whole question is one of economy, or rather of what direction a certain amount of energy should be utilized in to be most remunerative.

In any case, it is difficult to conceive that electrical energy can be more cheaply obtained than by the utilization of natural forces—the one most available being that of water power. Without discussing this somewhat abstruse question, there is for consideration the part which electrical energy plays in the utilization of atmospheric nitrogen. There are at present two distinct methods of research to accomplish this end. One is an indirect, the other a direct, method.

The indirect is briefly this: Calcium carbide is a product of the contact of carbon and lime under the high temperature of the electric arc. This compound placed in retorts at a high temperature in contact with nitrogen forms calcium cyanamide. The reaction is—$CaC_2 + N_2 = CaC\,N_2 + C$.

Calcium cyanamide is claimed to be a manure which can be used in place of sulphate of ammonia or nitrate of soda; but its comparative value has not at present been definitely determined.

The second method of utilizing atmospheric nitrogen is founded on the direct combination with oxygen under certain conditions—mainly that of exposure to the high temperature of the electric arc. As a result, nitric or nitrous acid is produced, which can be combined with an alkali (such as soda or lime) and used as a fertilizer.

It would occupy too much space to explain all the scientific reactions involved, and the conditions necessary for successful working. But this much is so far definite, that we are on the borderland of new discovery. The nitrogen present in the air is an unlimited quantity; and if its fixation could be economically effected, it would be a most serious matter for all industries which regard ammonia as a valuable bye-product

SOME TESTS ON CONTINENTAL GAS-RADIATORS.

As was mentioned in our review of the proceedings of the recent meeting of the Société Technique du Gaz, there were four gas-radiators from different manufacturers submitted in competition this year to the arbitrament of the French Gas Society. Exact details of the tests to which the radiators were subjected are given in an official report, from which, without repeating all the figures and other less important items, the following abstract translation is taken.

The objects of the tests were: (1) To examine the working of the apparatus with the view of ascertaining the points of their design and the quality of their construction; and also to find out to what extent the advantages claimed by the inventors were found to exist in actual working, and how they affected the output or efficiency of the apparatus; (2) to find out the amount of radiant heat from each, and its efficiency in heating the room; and (3) to inquire into the hygienic conditions fulfilled by their working.

The testing-room had a capacity of 56·5 cubic metres (about 1995 cubic feet). The calorific power of the gas was ascertained by a Junkers calorimeter. The hygienic conditions resulting from the working of the apparatus were determined by chemical tests, which consisted in finding the amount of carbonic oxide existing in the room after combustion. Neither the water vapour nor the carbonic acid was calculated; this being a matter of secondary interest.

The first apparatus tested was one called "Le Soleil" gas-radiator, made by M. Lacaille, of Paris. It consists chiefly of a line of bunsen burners with one air supply, the flames of which lick round asbestos fibre fastened on to a ribbed plate of white enamelled cast iron. This is slightly inclined to the front, so that the heat may be thrown out by the bottom. The products of combustion are taken away by a nozzle on the top. The maker of "Le Soleil" drew attention to five special features, which are criticized in the report: (1) The burner has some wire gauze, which prevents it firing-back whatever be the gas pressure. (2) The inclined position of the enamelled hearth is essential for the good working of the apparatus. The radiant heat is comparatively little. (3) The use of ribs or flanges is not new; but they undoubtedly assist in transmitting the heat to the surrounding air. The gas-flues carry the waste heat to the burner, in two ways—by radiation and by convection. The following table gives averages of several tests:—

Consumption per Hour Cubic Feet. (Pressure 1¾ in.).	T—θ.	Weight of the Products of Combustion per Cubic Metre (35·3 Cubic Feet) of Gas Burnt.				Heat Lost per Cubic Metre of Gas Burnt. Calories.	Calorific Power of the Gas.	Efficiency Per Cent.
		CO_2.	H_2O.	O.	N.			
		Kilo.	Kilo.	Kilo.	Kilo.			
16·951	581° F.	1·058	1·394	2·408	13·129	1409	4800	70·64
14·127	491	..	..	3·254	15·798	1391	4800	71·02
11·654	482	0·963	1·406	3·458	16·883	1438	5000	71·25
9·888	419	..	..	5·282	19·890	1479	5000	70·41
8·122	365	..	..	5·374	22·046	1374	5000	72·52

T = Temperature of the products of combustion.
θ = Surrounding temperature.

It will be seen from this table that the amount of air in excess varies inversely to the gas consumption, but the efficiency remains about the same. This is an undoubted advantage, because the gas-flues are not called upon to work always at their maximum. Although the average efficiency is the high one of 71·17 per cent., yet it is obtained under bad conditions, owing to the comparative insignificance of radiated heat. (4) The inventor drew attention to the arrangement of the cock allowing of regulating the gas consumed with the incoming air in proportion to the gas. Tests were made, but the products of combustion were the same, with or without the regulating slide. The amount of air was the same, and so the efficiency was the same. The regulating slide was of no effect. Figures are then given to show the radiant heat from the apparatus, and its efficiency in heating the room. The test for the latter lasted an hour; the temperature of the room before the test was 17·35° C. (63·03° Fahr.), and after the test 20·8° C. (or 69·44° Fahr.)—thus showing an increase of temperature of 3·45° C. (6·41 Fahr.). The gas used was 414 litres, or 14·621 cubic feet.

The next radiator tested was called "Le Merveilleux" and was made by MM. F. & L. Engels, of Lille. This apparatus, as our former report stated, obtained an award of 400 frs., or £16. The gas is led by a double injector of T shape into a cylindrical chamber formed by a cast-iron tube. Here it meets with the air,

the intakes for which are almost on the level of the ground, so as to get as cold air as possible and containing the most oxygen. The mixture of gas and air meets an obstacle in the upper part of the apparatus, consisting of two cross plates perforated with holes of different sizes, getting bigger as they reach the centre. Then there follows a metal *grille*, which effects a more thorough mixing of the gas and air, and prevents firing-back. After this mixing gauze or *grille*, the gas passes directly to the burner, and heats a vertical fire-clay plate with grooves, on which is fastened the asbestos fibre. On first being lighted, the products of combustion go directly to the chimney; but after about 10 minutes —that is to say, when the suction flue is heated—this direct passage can be shut by means of a flap, and the waste heat led into two side walls forming chambers. These become heated and give off radiant heat. The products of combustion re-unite in the lower part of the front of the big cylinder, thence pass into a bottom chamber opposite the hearth, and so to the vent pipe.

The burner never once fired-back during the tests. As regards the return of the flame, this means a greater amount of metal to be heated, and forms, by reason of the air contained in it, a kind of separating mattress which retards the transmission of heat by convection. The apparatus is thus badly arranged for suitably transmitting part of its heat by convection. The conclusion arrived at is that, during the time of lighting up, "Le Merveilleux" does not utilize as well as other gas-stoves the calories given off by combustion, and that this inferior efficiency is due to the return flames, which are only of advantage when the vent-pipe is working in its normal way. This takes place directly the draught commences, and the flap-valve is turned so as to shut off the direct passage of the waste gases, and thus force them to follow the return flames. Tests were made to ascertain the heating efficiency of the apparatus with direct draught with the flap opened, and with the return flames with the flap shut. The following table, which is comparable to the previous one, gives the results:—

Consumption per Hour. Cubic Feet. (Pressure 1¾ in.)	Kind of Draught.	T−θ.	Weight of the Products of Combustion per Cubic Metre (35·3 Cubic Feet) of Gas Burnt.				Heat Lost per Cubic Metre of Gas Burnt.	Calorific Power of the Gas.	Efficiency Per Cent.
			CO_2.	H_2O.	O.	N.			
		Fahr.	Kilo.				Calories.		
38·849	Direct draught	680°	0·825	0·128	3·063	14·381	1760	5000	64·78
	Return flame	617	,,	,,	1·347	8·839	1028	,,	79·42
31·785	Direct draught	581	,,	,,	3·871	17·100	1761	,,	64·66
	Return flame	536	,,	,,	2·648	12·315	1187	,,	76·25
26·487	Direct draught	518	,,	,,	4·820	22·060	1933	,,	61·33
	Return flame	473	,,	,,	3·372	15·131	1264	,,	74·72
21·190	Direct draught	437	,,	,,	7·327	28·231	2070	,,	58·60
	Return flame	410	,,	,,	4·417	19·056	1329	,,	73·42
19·424	Direct draught	410	,,	,,	6·900	31·770	2101	,,	57·98
	Return flame	383	,,	,,	4·712	20·931	1342	,,	73·16

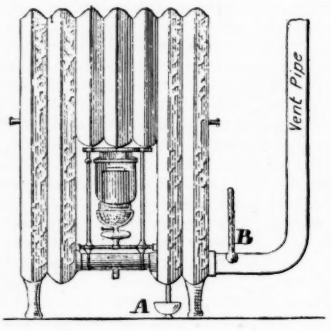
It will be seen that it is necessary to work the apparatus at its maximum output in order to have the maximum efficiency. The average of the efficiency figures given in the table is, for the return flame, 75·39 per cent., and 61·47 per cent. for the direct draught. The return flame thus gives a very good utilization of the calories produced, and is a real improvement. On the other hand, the direct working is ordinary, and the user's attention ought to be called to the utility of only employing this direct draught during the time of getting the draught into operation. As regards the efficiency in heating the room, the hour's test raised the temperature from 19·25° C. (66·65° Fahr.) to 24° C. (75·2° Fahr.); being an increase of 4·75° C. (8·55° Fahr.). The gas used was 793 litres, or about 28 cubic feet.

MM. Moreno and D'Antony, of Turin, submitted the "Vulcano" radiator for examination. It is shown in figs. 1 and 2, and does not need any detailed description, being merely a special burner applied to the form of a syphon-stove. The burner consists of an inside perforated sheet cylinder, open at the bottom for the air inlet and closed at the top; so that the air can only pass out by the small holes, which form a sieve, and by mixing with the gas. A second concentric cylinder, also of perforated sheet, covers the first, and the gas, which enters at the bottom, burns in the annular space between them. The outside air enters at the top in an annular space between a third and fourth glass cylinder. A copy of the patent of April 29, 1905, is set out in part in the Société Technique's report, which states that the first claim made is "in complete disagreement with elementary notions of chemistry." The flame was quite unsteady, and continually oscillated the lips A of the burner (fig. 2) up to the crown B, causing vibration and noise. The table to compare with the two previous ones is as follows:—

Consumption per Hour. Cubic Feet.	T-θ.	Weight of the Products of Combustion per Cubic Metre (35·3 Cubic Feet) of Gas Burnt.				Heat Lost per Cubic Metre of Gas Burnt. Calories.	Efficiency. Per Cent.
		CO_2.	H_2O.	O.	N.		
		Kilo.	Kilo.	Kilo.	Kilo.		
3·178	53·6°F.	0·772	1·233	6·668	26·578	104	97·91
4·238	65·3°	0·772	1·233	6·041	27·070	160	96·79
10·595	73·4°	0·629	1·193	2·587	12·793	101	97·09
19·424	95°	0·629	1·193	0·965	6·794	94	98·12
28·959	102·2°	0·629	1·193	0·224	4·276	70	98·60

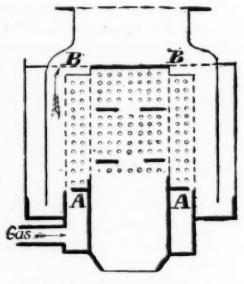
The efficiency is high, as in all such apparatus in which the cooling surface is considerable compared with the heat given off. They heat by convection only without any radiant heat, and have the inconvenience of heating the upper layers of air, and not at the floor level, as stoves with incandescent refractory material do. During an hour's test on the heating of the room, 347 litres of gas (or 12·254 cubic feet) were used; and the temperature was raised from 21·65° C. (70·97° Fahr.), to 22·55° C. (72·59° Fahr.).

The fourth and last heating apparatus tested was a radiator manufactured by M. van den Driessche, of Brussels. It consisted of a large central bunsen burner covered by three bells of refractory material. Each covers the other, and they are very thin, perforated, and parallel one to the other, with very little space between. The combustion of the inside chamber is very incomplete; and the unburnt gases pass to the other chambers, which give a source of heat raising the set of diaphragms to incandescence. In the outside chamber, the percentage of nitrogen was found to be lower, and that of oxygen higher, than in the middle chamber. This excess of oxygen shows that the combustion was complete in the middle chamber; in other words, with a consumption of 800 litres (28·253 cubic feet) per hour, two bells would have been sufficient. By varying the pressure, the flame



A. Saucer for Condensation.
B. Test Hole for Temperatures.

FIG. 1.



A. Tip of Burner.
B. Crown of Burner.

FIG. 2.

The "Vulcano" Gas Radiator.

could not be made to pass through the holes of the outside bell, which confirms the previous conclusion. The burner forms an excellent regenerative apparatus. It is capable of most interesting adaptations; and its working, after being regulated, was perfect, and there was no firing-back. It raised the temperature of the room after one hour's burning from 20·55° C. (68·99° Fahr.) to 25·4° C. (77·72° Fahr.); while the gas consumed was 747 litres, or 26·381 cubic feet.

Next Year's Examinations in Gas Manufacture.—We have received from the Publisher (Mr. John Murray, of Albemarle Street) the programme for the session 1906-7 of the Department of Technology of the City and Guilds of London Institute. It contains, as usual, regulations for the examination of candidates in a large number of technological subjects, including "Gas Manufacture" and "Coal-Tar Distillation and Products." The Examiner for the former subject is Mr. A. F. Browne, of Vauxhall, and for the latter Professor A. G. Green. The examinations in "Gas Manufacture" will be held on Saturday, the 20th of April, from 2.30 p.m. to 6.30 p.m.; and those in "Tar Distillation" the following Thursday, from 7 p.m. to 10 p.m. The questions set by the Examiners will be based on the syllabuses contained in the programme, in which will be found particulars in regard to the certificates and prizes, as well as lists of the works recommended for the candidates' study. The price of the programme is 9d. net.

BRITISH ASSOCIATION OF WATER-WORKS ENGINEERS.

ANNUAL MEETING AT SCARBOROUGH—JULY 12 to 14, 1906.

PAPERS READ.

(1)

RURAL WATER SUPPLIES.

By J. MITCHELL WILSON, M.D.,

County Medical Officer of Health, East Yorkshire.

When asked by your President to read a paper on rural water supplies, the author very much appreciated the compliment paid to him and consented, but with some fears lest the views of a Medical Officer of Health might not adequately deal with the phases of the subject most interesting to engineers. We are, however, all agreed that the water supply of rural districts is a most urgent question, and the most far reaching in its effects upon the health of the district of any which a sanitary official has to consider. Its direct influence in causing disease—either alone or through the medium of the milk supply, on those living in the immediate neighbourhood or in far distant towns—has in recent years been too often demonstrated to need rehearsing. Life in a country district where the inhabitants are provided with an adequate supply of wholesome water is indeed worth living by comparison with that of those who have to depend upon supplies of water inadequate in amount and obtained from sources likely to yield a more or less polluted water.

Reports by the Medical Inspectors of the Local Government Board on the sanitary conditions and the water supplies of rural districts in various counties, confirm the opinions so often expressed in local Medical Officers of Health reports as to the unsatisfactory nature of the supply in some parts of their districts. These reports tell us of outbreaks of enteric fever which are traced to the use of drinking water, and that water in turn is shown to have been polluted by matters which have probably acted as the carriers of the germs of the disease. Many of these repeated outbreaks in rural districts are little heard of outside the area in which they occur; for the actual number of cases is too small to interest the general public. But when they are stated in terms per 1000 of the population, they equal in incidence many of the larger and more generally quoted epidemics. To lessen these rural miniature outbreaks, experience has taught us, requires that the dangerous and suspicious water supplies shall be replaced by wholesome water.

The author's purpose is to again urge this matter upon you as one deserving our united and active endeavours, especially as it concerns rural districts. At the very outset, our work is beset with legal difficulties; and a short *résumé* of the powers under which this work may be carried on will be of interest. Under the Public Health Act, 1875, all District Councils, both urban and rural, may supply their districts, any contributory place therein, or any part of such contributory place with water. Under section 62 of the same Act, power is given to supply a single house. But this section is unworkable in many rural districts, for it is only applicable where a general supply has been provided. The passing of the Public Health (Water) Act, 1878, however, met to some extent the special requirements of rural districts. The opening words of section 3 of this Act are: "It shall be the duty of every rural sanitary authority to see that every occupied dwelling-house within their district has, within a reasonable distance, an available supply of wholesome water." This is a very definite and specific duty for the rural sanitary authority to carry out; but the whole action is controlled by subsequent and very important words in the section which states that "regard must be paid to the subsequent provisions of this Act." The most important of these provisions that we need consider at present is that which establishes the standard of "reasonable cost." This standard, you may remember, is one which limits the capital expenditure in providing a supply, to a sum the interest on which, at the rate of 5 per cent., will amount to 2d per week, or the increased amount of 3d. per week if the Local Government Board consider that to be reasonable.

There is an all-important difference between the Acts of 1875 and 1878 in this matter. In the former, the cost named is not to exceed the water-rate authorized in the district. Therefore the charge is for the water itself, and is an annual one payable usually by the tenant. In the latter Act the cost is for the expenditure necessary to procure the water, and is not an annual charge. This limitation of the cost in providing the supply is the reason why it has proved so very difficult to secure proper supplies of water in rural districts. Those who have had experience on this matter will admit that some limit as to the cost of a supply by the owner of a single existing house is necessary; for in those districts where the water supply can only be obtained from deep wells, the cost might exceed the rent of the house for many years.

As regards a new house, the Act provides that the owner shall not allow it to be occupied until he has received from the sanitary authority a certificate that there is provided such an available supply of wholesome water as may appear to be sufficient. In this case, there is no limit as to the cost. It is 28 years since the Act was passed, and it might be expected that for all the houses erected during these years a satisfactory supply of water would have been provided. But it is unfortunately the fact that in many districts, especially in those where no building bye-laws have been adopted, it has not been the rule to enforce the requirements of section 6. Hence we have to face this difficulty, that many houses have been built and occupied since 1878 which have not a satisfactory water supply; and the owners cannot now be called upon to provide such supply, unless within the limit of cost named in section 3. Another hindrance in this work is the fact that the cost is per house, without any variation according to its rateable value. The provision of water for a farmhouse or village inn is subject to the same limit as in the case of the labourer's cottage. Further, the owner of a group of houses—say, 5 to 10—where a supply is necessary, cannot be required to spend five or ten times the limit of cost for one house, so that one good supply for the whole of the 5 or 10 houses might be provided. But sub-section 5 of section 3 provides for a joint water supply where the owners of two or more houses have failed to carry out the notices served upon them—provided no greater expense is occasioned than the Act sanctions. The procedure on appeal by the owner is very intricate; and my experience is that local authorities, having served notices on the owners, prefer to let them lapse rather than attempt to carry out all the legal requirements set down as necessary before a new supply can be provided.

As you are again met in Yorkshire, and as for many years the author was greatly interested in the water supplies of a considerable area in the West Riding, as he is now also in the East Riding, it seemed to him that the broad acres of Yorkshire might afford sufficient variety of sources of water supply, both as to the quality of the water and of the means whereby the requirements of rural districts can best be met, to warrant the choice of local examples, rather than those over a wider area.

The special interest in such a review lies in the fact that the geological conditions existing in such variety in Yorkshire are to be found, probably not in so complete a series, but in part, in every other district in England; and in this meeting—representative as it is of many diversely situated districts—we must surely find some common experiences to discuss. Beginning at the northern and western boundary of Yorkshire, in that hilly country we meet with the conditions where many of the most important rivers in Yorkshire and Lancashire (as the Aire, the Ribble, and the Wharfe) originate. It is from the tributaries of these rivers that some of the softest waters in England are obtained—the author had almost said the purest of waters also, but this might be objected to owing to the occasional presence of peat in the water. The Yoredale series and Millstone Grits contain no calcium carbonate to harden the water; but the Wharfe and the Aire below Malham Tarn have been flowing over the carboniferous limestones, and their waters are therefore harder. The rain is very abundant, and flows rapidly down the steep hill-sides where the population is very sparse. For the villages in that neighbourhood, the water supplies are largely obtained from springs, streams, and open dip wells; while some are more fortunate in obtaining a supply from the mains of local water-works companies. But even there the supplies are defective in dry seasons; and it is especi-

ally for the proper supply of villages in such districts that powers similar to the well-known Manchester water-works clause ought to be enforced, which would require every authority which obtains water from any given district to supply the local authorities on the line of their mains with water on reasonable conditions.

In the south-western portion of the county, the coal measures extend over a considerable area, with a large population. The inhabitants of the towns have secured their water supplies from distant sources. But the supply in colliery villages used to be totally inadequate, and of a very doubtful quality. Local wells were often very shallow, and householders had to carry water long distances from pipes conveying land drainage. Water is met with often in large amounts in sinking the coal-shafts; and when it has been tubbed back, it is again sought for by well-sinking and bores. The water found in the oak rock or grey sandstone of these measures, is free from organic impurities. It is, however, very hard, and often contains traces of iron. Occasionally water drawn from the same strata is found to be heavily charged with common salt. In the colliery districts, the provision of a wholesome water supply must nearly always be undertaken by the sanitary authority, unless the colliery company generously provide it; and a supply from a source other than the coal measures is greatly preferred.

Lying immediately above the coal measures, the Permian system extends from near Bedale in the north to the south and east of Sheffield. In the villages the water supply is very often a restricted one, as the wells have to be sunk to a considerable depth through the hard magnesium limestone, and the cost is too great for single landlords to provide; so the tenants are compelled to store rain water or to carry the hard water from the publicly-provided wells. The water in properly constructed wells is usually pure, but extremely hard, and a very little softening takes place even after it is boiled, as the hardness is due to sulphates of lime and magnesia, and may equal 56° of Clark's scale. Again, the only hope for the rural householder is that a general scheme of water supply shall be provided for the district.

The trias formation overlies the magnesium limestone, and satisfactory rural water supplies are by comparison more easily provided from the new red sandstone than from any other formation. It extends over the whole length of Yorkshire, from Darlington to the south of Doncaster. In this country, there are only two of the divisions of the trias met with—namely, the keuper and the bunter beds. In the pebble beds of the latter, is the source whence one of the most wholesome water supplies is obtained over a large part of England. The towns of Goole, Selby, Pontefract, and Tadcaster within the same area in the West Riding, and many of the large towns in the Midlands and Lincolnshire, have secured supplies of water from the trias. The water from the sandstone near to the outcrop is very free from organic impurities; it is moderately hard (14° to 20°), and this is considerably reduced by boiling. This is the character of the water from the deeper wells—that is, those sunk 80 feet or more; but the shallow wells too often yield a supply which has had added much of the surface and subsoil pollutions. The compact sand which overlies the actual rock has been long trusted to filter off all impurities which might reach the shallow well waters; but a time comes—as analysis so often proves—that a fouled subsoil can only yield a contaminated water. The Public Health (Water) Act of 1878 does not meet the case, where a deep well or bore is admittedly the only sensible action, and a make-shift shallow well is provided, or, worse, the old one is cleaned out, forgetting that the source of the pollution remains untouched outside the lining of the well. When a private owner or sanitary authority can be induced to provide the best water from the deeper strata, every endeavour ought to be made to secure it or to obtain a supply on suitable terms from some company or urban district council whose mains may pass through or near the district.

It was in a red sandstone district the author first learned that a single deep well could be a most effectual preventive of endemic enteric fever in a village. The cases occurred year after year in the same neighbourhood. The shallow well waters were impure in spite of cleansing, and new shallow wells yielded water of the same character as that from the old wells. But the sanitary authority having provided a deep-bore well close to the houses, but secure against all local pollutions by having the barrel of the pump directly connected to the lining tube of the bore, the cases of fever ceased, and householders in other parts of the parish soon insisted that three additional similar bores should be provided for their protection. Throughout the eastern portion of the Vale of York, the upper division of the trias—namely, the keuper marls and sandstones—prevail instead of the bunter beds. The water in the former is not so satisfactory a supply for household purposes, although it is highly thought of for brewing. It is a very hard water, through containing a larger percentage of lime sulphates, nitrates, and chlorides. It frequently contains objectionable traces of iron.

The author has had very little experience of well waters or supplies obtained from the oolite formation; but your President will be able to assure us as to its suitability for all purposes, as the water supply of Scarborough is obtained from this source. The most recent of all the rocks in Yorkshire from which water supplies are obtained is the chalk. The character of this water, whether obtained from the Yorkshire Wolds, from London, or from Brighton, is at all points alike. It contains from 10 to 15 grains of lime carbonate per gallon. About four-fifths of this amount is removable by boiling or by softening. The water contains nitrates in larger amount than any other deep well water. But they are the result of organic impurities of long past ages when the chalk was laid down; and the presence of these nitrates does not detract from the wholesome and satisfactory character of the chalk waters. Considered as a source of water supply in rural districts, however, the question of cost presents difficulties, as the water can only be made available through the sinking of wells to a considerable depth. Such wells must be provided by the district council at the cost of the particular parish to be benefited.

Throughout several districts on the border of the Wolds, where the boulder clay which overlies the chalk is much thinned out, boreholes made through the clay into the chalk result in securing a continuous flow of water above the ground level. These overflowing wells are a great boon in rural districts; and if in an exceptionally dry year they cease to run, a pump attached to the bore-tube always serves to secure water. But from the Wold districts we have copious streams of water flowing from springs in the chalk, where it is resting upon kimeridge clay. These streams are evidently designed for the use of the rural districts, and no other substitute, such as parish or other wells, can be compared to the scheme which conveys such a supply in a pure state near to the houses. Unfortunately, chalk streams are too often polluted in their course to be used for drinking, and the water must be collected in a pure state near the source and carried by mains through the villages, or a deep well may be sunk, the water raised to a reservoir by windmill, and then distributed throughout the village.

Your President can tell you of a scheme which he carried out six years ago for the supply of one of our East Riding parishes. The satisfaction which that scheme gives to the ratepayers was recently shown by their application to have it extended, so that all might share its benefits. In regard to the value of wind as a motor power, the following quotation from a letter received by the author from the parish overseer will be of interest: "The wind-engine is in every way satisfactory, and during the last six years I can only find that we have paid £4 for horse power. We have had no breakdown as yet, and the only new thing about the mill is a leather valve, which cost 7s. 6d."

Covering the chalk on the eastern side of the county, we meet with new deposits in which to find our rural water supplies. The Glacial period left immense deposits of clay, more or less full of boulders, and also containing numerous patches of gravels. These local deposits consist mainly of chalk gravels, laminated clays, warp, or alluvium; and if we substitute river gravels for those of chalk origin, the conditions here may be said to be similar to those prevailing over a large portion of the whole country. It is from a subsoil of such varied composition that the greatest number of our local water supplies are obtained by means of shallow wells. The rainfall within a narrow circle, which is the source of supply for all such wells, filters through the surface soil into a bed of sand or gravel until it reaches an impervious layer of clay or marl which forms the gravel bed into a reservoir.

Water obtained by means of a well on private premises is affected by the conditions surrounding the well; and it is only in those rural districts where building bye-laws are in operation that there is any guidance laid down as to the protection of the water, and then it is only by prohibiting the construction of any privy, ashpit, or cesspool within a stipulated distance of the well. But while advice is given to

sanitary authorities and their officials as to how drains should be laid, and model bye-laws are suggested to regulate many matters of sanitary interest, there is no official advice given as to the precautions required in sinking wells. In many districts the advice of the sanitary inspector or the surveyor is rarely asked, and if any hints are offered they are not always followed. It is because in any day's inspecting work one sees so many wells made in a primitive way, or defective in some important points, that the need for some elementary rules seems so urgent. The site of the well ought to be chosen after due consideration of every possible source of pollution, either on the premises to be supplied or on those of the nearest neighbours.

In the construction of wells, it is essential to use some means of keeping out the water from the upper layers of the soil, as leakages from drains, ashpits, and fold-yards, which are very common, are to be found near the surface. Lining the well with dry bricks is of no use as a protection to the water; the bricks ought to be set in mortar or cement, and a backing of well-rammed clay is an additional security. Glazed sanitary well-tubes, 3 feet in diameter, are effectual where the subsoil is suitable in which to work them. Steel tubes are also very suitable; but, unfortunately, the cost is beyond the limits of the Public Health (Water) Act for single houses. Of equal importance is the finishing of the well to protect the water against surface impurities, which are believed by many to be more frequent than those from the well sides. The top of the well should be dome-shaped, and raised above the ground level; this being preferable to a covering of flag stones. Every well should have the pump cased in, and the ground about the latter covered by a good layer of cement concrete, in which a small channel ought to be formed from the pump to a gully drain placed 3 feet from the well.

These, or similar precautions are absolutely necessary to secure wholesome water from shallow wells. The analyses of waters from such wells commonly show that they have to-day, in many cases, the same character as when the Royal Commission of 1867 described the water obtained from shallow wells in the coal measures as of "very filthy origin." Of those in the new red sandstone, the Commissioners said: "The sources of pollution surrounding shallow wells are so general, numerous, and potent as to leave few of the many samples enumerated of sufficient purity for safe domestic use, although most of them were clear and palatable." Of those in alluvium and gravel, the report says: "The results show that, while a large number of the shallow wells in the alluvium and gravel yield palatable water, only 13 samples (out of 29 analyzed) could be used for domestic purposes without much risk to health." This sketch of the general conditions which affect the water supplies in rural districts throughout Yorkshire must in some degree agree with the experience in other counties.

In discussing the amount of water actually used per household in towns and in the country, from 15 to 20 gallons per head is allowed to be a fair average in the former, while 5 gallons per head is held to be above the average amount used in the latter. One need not discuss the reasons for this difference. It is obvious that a supply close at hand is available for the townsman, while the 5 gallons used in country houses are only obtained by the expenditure of much time and labour in raising the water and conveying it some distance from the source. Again, the town householder has rarely much personal concern as to the wholesomeness of the water he uses, for that is a mutual concern for hundreds of householders and of the sanitary authority. But the well water which supplies one or a small group of houses may be seriously polluted until some illness attracts the attention of the Medical Officer of Health or Sanitary Inspector, and then the difficulty arises of finding an adequate remedy under the Public Health (Water) Act. It was evidently the intention of the framers of this Act that houses, both new and old, should be provided with a sufficiency of wholesome water. This end is yet far from being accomplished; but the experience of past years may be worth much if it serves to convince the framers of the next Public Health Act that it is almost impossible to hope for a wholesome supply of water to be obtained from shallow wells under the limits laid down in the Act of 1878.

The water supply for solitary houses must nearly always be from private wells; but failing this source, ample and safe means should be made for storing rain water. For groups of houses or small hamlets, public wells, if carefully made, will provide more wholesome water than the private shallow wells; while for larger villages the water supply ought to be provided by the sanitary authority. This ideal state will not be reached yet; but I believe it would eventually result in the prevention of disease among the rural population, and ultimately in a saving of money which is at present not wisely used in sinking private wells. At any rate, we must be agreed that all works of water supply, including the sinking of wells and the construction of tanks, ought to be under the direction and sanction of the sanitary authorities. The cost of any work for supplying water in districts with a small rateable value is the chief obstacle; but when such work is carried out thoroughly (even in only sinking a well), it should be possible to spread the cost over a number of years. In this matter, the county councils might assist the rural authorities; for until more wholesome supplies of water are provided, we can never hope to have satisfactory results for all our sanitary work in rural districts.

The powers of local authorities in Scotland, both as regards providing and paying for works of water supply for houses, far exceed those contained in the English Acts of 1875 and 1878. Section 125 of the Public Health (Scotland) Act, 1897, "requires water to be supplied to any occupied house; the local authority may do the work and recover in a summary manner from the owner the whole or a reasonable part of the expenses incurred by them under this section."

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(2)

WATER SUPPLY IN A DAIRY DISTRICT.

By WILLIAM PHELPS.

One of the questions most seriously engaging the attention of those charged with the sanitary administration of our rural areas, engaging also doubtless to some extent the attention of many members of this Association, is: How may such areas be supplied with pure water without creating an inordinate burden upon the larger ratepayers residing in the small villages and hamlets scattered at wide distances over them? Many rural schemes have been carried out in recent years; but, in the author's opinion, in obedience generally to the dictates of the higher sanitary powers of the land, and against the will of the inhabitants, rather than with their concurrence. The burden created has often lain heavy upon the occupier of land, and has given rise to much complaint. As it is not unusual for one-half at least of the total annual charges to be borne by the general body of ratepayers (many of whom are often in no way benefited), it can scarcely be held that these complaints are without some justification, notwithstanding the generally accepted principle that all persons living within a contributory area must be called upon to share its burdens independently of their personal and direct benefit.

The subject was dealt with in an able manner in a paper read before the Association by Messrs. Dewhirst and Keywood in 1902; and since that time it has been consistently included in the list of subjects upon which communications are invited by the Council. The general conclusion arrived at by the authors of the paper above referred to, on the subject of finance, may be here stated. It is as follows:—

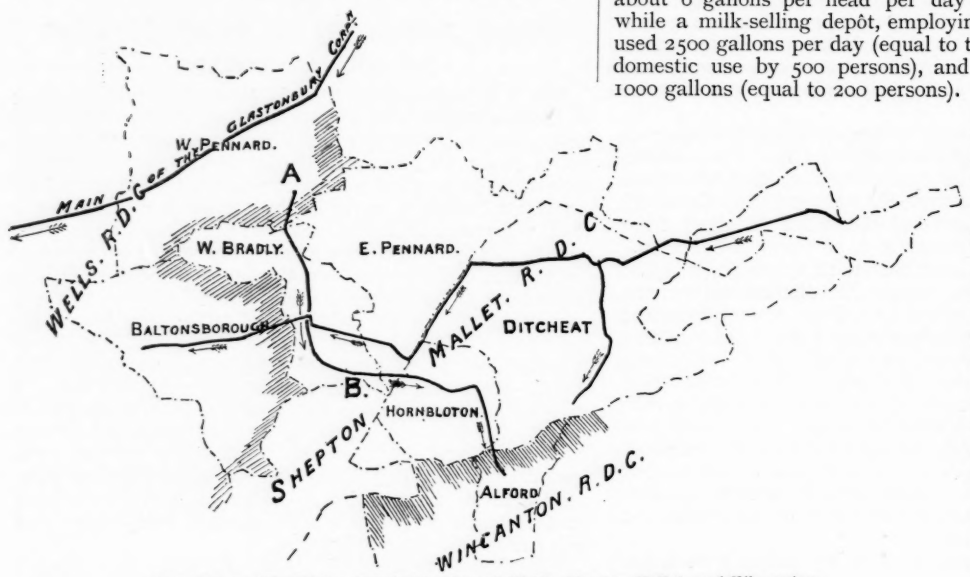
> **It is often argued that the water-rates should be sufficiently high to repay, not only the interest and repayment of loan, but also the working expenses. But the authors are strongly of opinion that it would be impossible to adopt this course in schemes similar to those described in this paper, owing to the fact that cottages under £10 rental cannot be charged more than 3d. per week (and that only in exceptional circumstances); and therefore the amount charged to houses above that rental and for trade purposes would be practically prohibitive.**

The Purleigh water scheme was quoted as an instance; and the figures given certainly tend to support the contention. Although he is not prepared to traverse this conclusion as a general proposition specially applicable to the cases under consideration, the author of this paper will endeavour to show that the careful study of the requirements of trade consumers of water in some rural areas, and the possibility of obtaining high prices for their supply, may often lead to a much nearer approximation towards a self-supporting scheme than was obtained in the Purleigh case, even when the circumstances are apparently somewhat similar.

Rural sanitary authorities, guided by their Public Health Acts, and circumscribed by an inherent conviction that as sanitary authorities they are not charged to consider the trading needs of their districts, have, in many cases, narrowed their schemes, and burdened their constituents with a costly

sanitary luxury, where a little more liberal appreciation of the necessities of the case would have provided an undertaking, which, if not self-supporting at once, might soon have tended to become so. The supply of pure water to dairy farms may be regarded as a sanitary necessity, and is generally so considered now that the manufacture of cheese has to so great an extent given place to the production of milk for town consumption. It will, however, be well not to lose sight of such supply from a commercial point of view. Thus it is the author's practice to consider it with other rural industries, such as breweries, cider factories, creameries, builders' yards, slaughter-houses, the supply of steam boilers in various trades, and the providing of drinking troughs for cattle on grazing lands.

A comparative table (Table A) which is appended to this paper will show that, although the county of Somerset may possibly not be quite so sparsely populated as Rural Essex, the cost per head of population supplied by some of the schemes there mentioned is even higher than in the cases mentioned by Messrs. Dewhirst and Keywood. It is, however, obvious that a sum of money spent in providing a gravitation scheme, where working expenses are very small, is an entirely different matter from the spending of a similar sum upon a pumping scheme; and, for this reason, an attempt has been made to arrive at a more suitable basis of comparison. The annual cost of the scheme per head of the population supplied (column 12), the annual revenue (column 14), and the ratio between the two (column 15) together constitute, it is contended, a fair basis of comparison to which all rural schemes may be referred as a measure of their financial success. It is further submitted that a higher revenue per head should be aimed at—and may generally be obtained—than that shown for Purleigh, and that it should be a very rare case in which the annual revenue falls below 50 per cent. of the annual cost. The delineation of a few of the principles which, from the author's experience, need to be observed, and the conclusions at which he has arrived, will, he hopes, be of some interest to the Association; while, to make the paper more complete and further illustrate these principles, details of a scheme recently carried out are appended.



Plan No. 1.—The Water Supply Districts of Wells, Shepton Mallet, and Wincanton.

(A) *Supplies by Meter.*—No supply, which is wholly or in part a trade supply, should be given except by meter, unless under very special circumstances. The difficulty (amounting almost to an economic impossibility) of close inspection of fittings and control of waste, in wide areas, renders this necessary. In dairy farms especially should this rule be observed, for the writer has found that, over an average of 3 years, the consumption of 15 large farms (served by meters) has amounted to no more than 87 gallons per farm per day; while in the case of unrestricted supplies, he has known farms to consume, or waste, from 800 to 1000 gallons per day each. In the former case, existing supplies have without doubt been utilized for many purposes; and it is well that this should be so, as the opportunities for waste and undue consumption of pure water in farm houses and yards are unlimited. The difficulty of providing space for meters, and the objection to surface boxes in footways, do not obtain in rural as in urban areas; while the cost of the meters relative to the total cost of the scheme will be generally less in the former.

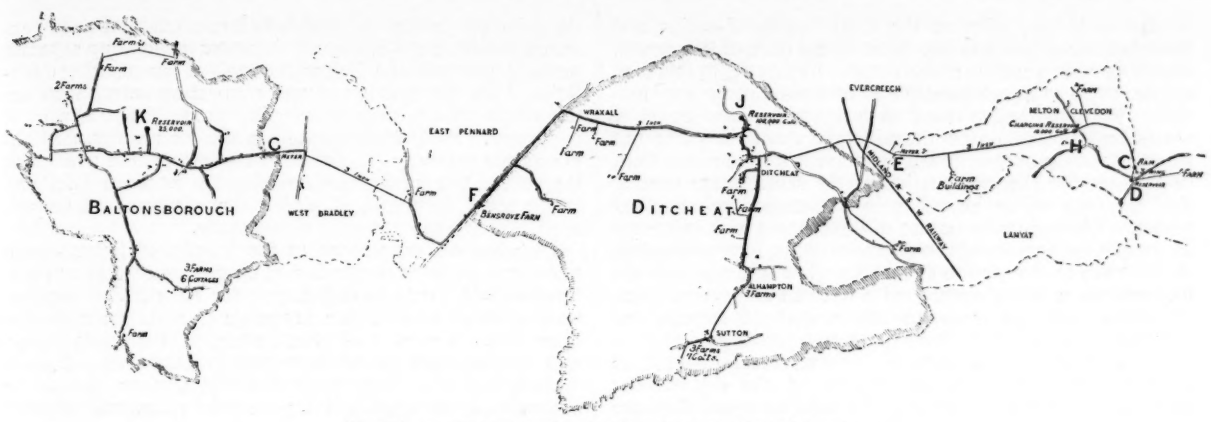
(B) *Minimum Charge.*—In the case of farms supplied by meter, some provision must be made to prevent the public supply being used as a convenience in emergency only. In many cases, farms have independent supplies which will serve their needs, except perhaps during a month or two in summer. Some provision is necessary to secure that a farm to which a supply is provided shall contribute a reasonable sum towards the annual charge due to initial outlay and working expenses. This is generally done in the author's experience by fixing a minimum charge, payable half-yearly in any case, based upon the rateable value of the premises, *plus* one-fourth the rateable value of the land occupied in connection with it, in the same way that a special sanitary rate would be levied. The rate will vary with circumstances from one-half to three-fourths of the rate charged on domestic premises without meters.

(C) *Population not a Sufficient Basis for Quantity required.*—The author submits that where water is taken from standpipes and wall-fountains, as is usually done in villages, 5 to 6 gallons per head per day is all that is required or will be used, for domestic purposes only, by cottagers. He further finds that, over a period of three years, 21 meters fixed to domestic premises where some small trade was carried on showed an average consumption of 24 gallons per house, or about 6 gallons per head per day only, including trade; while a milk-selling depôt, employing two or three hands, used 2500 gallons per day (equal to the amount required for domestic use by 500 persons), and a steam-boiler supply 1000 gallons (equal to 200 persons). The usual assumption of 15 gallons per head is therefore quite misleading as a general basis in rural supplies. A careful study of actual and probable trade requirements must be made in detail to obtain a reliable estimate, and liberal allowance be made for trade developments.

(D) *Charges for Water.*—The charges for water in rural areas should be, and may be, higher than those generally obtaining in any urban areas. Supplies now under the author's control are working with water-charge rates varying from 3s. in the pound per annum (downwards) on the rateable value of premises for domestic use. Properties in villages being usually assessed at a low rate, the actual charge is not so high as would appear at first sight. As regards charges by meter, the sliding-scale [Table B. appended] is the one usually adopted by the author. The charges there set out are in force without deduction in two cases; while in other cases deduction from the scale is made, ranging up to 50 per cent., according to circumstances. Cases may be cited of consumers taking over 2000 gallons per day for trade purposes on this scale without deduction.

(E) *Capital Expenditure.*—Sums which would usually be considered in urban areas to be beyond reasonable limits in proportion to population, may often be expended without serious consequences. One case may be cited in which the expenditure per head was over £8, and another where the expenditure was close upon £7, while in the latter case the water had to be purchased by meter. In both cases, the full borrowing power of the parish for sanitary purposes was practically exhausted by the loan. This, however, is not necessarily considered by the rural ratepayer as being an unmixed evil, tending as it does to consign to the distant future a possible sewage scheme which he dreads.

(F) *General Administration of Water Supply.*—It is submitted, and will probably be generally admitted, that, where possible, a number of villages and hamlets should be supplied from a common source, with a view to reducing the delays and expense consequent upon dealing with many



Plan No. 2.—The Ditcheat and Baltonsborough Water Scheme.

small schemes and the acquisition of many small sources of supply. The author considers, however, that, until some better machinery is available for dealing with the conflicting interests of small but distinct units of Local Government (other than mutual agreement or a costly Bill in Parliament), little progress on these lines can be made. While fully agreeing as to the desirability of Water Boards dealing with areas whose boundaries are coterminous with watersheds, the author contends that the establishment of such Boards should be preceded by a hydro-statistical survey of the whole country, the better to enable the correct areas to be delineated, and so that Water Boards, when formed, should be in possession of the information necessary to the proper execution of their functions. It is further contended that County Councils are naturally the bodies who can best carry out the local collection of such information, on lines which should be laid down for them by the Local Government Board. It is suggested that a short Bill (which might reasonably be non-contentious) should be introduced by the Local Government Board, enabling and requiring County Councils to collect information as to: (1) The existing public water supplies within their area. (2) The portions of their area not yet furnished with public water supplies. (3) The available sources of water supply within their area. (4) Suggestions for schemes to supply areas not already having a public supply. Such a Bill would need to contain certain mandatory provisions, requiring persons in control of existing supplies to furnish information, and to enable the officers of the County Council to enter upon private lands for the purpose of gauging springs, streams, &c. With such information available, the Local Government Board would the better be enabled to judge as to the necessity for Water Boards; and it might possibly be found that the constitution of Joint Committees, in the case of watersheds situate in two or more counties, would alone be necessary to obtain a complete administration over the water supply of the whole country, and thus meet the obvious objections which may be urged against the creation of entirely new bodies.

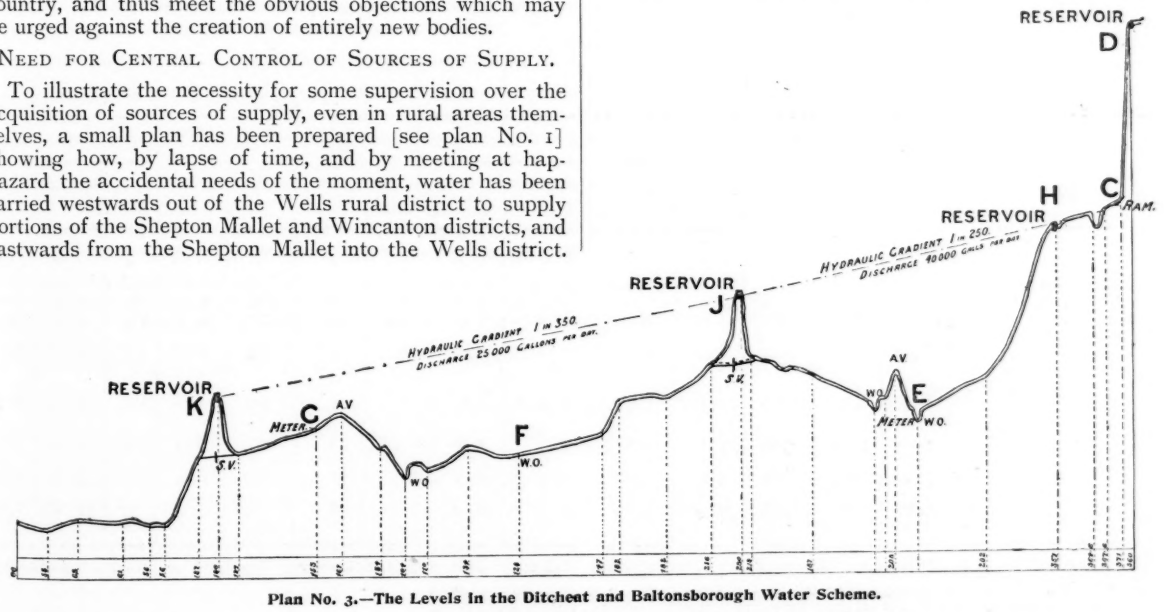
Need for Central Control of Sources of Supply.

To illustrate the necessity for some supervision over the acquisition of sources of supply, even in rural areas themselves, a small plan has been prepared [see plan No. 1] showing how, by lapse of time, and by meeting at haphazard the accidental needs of the moment, water has been carried westwards out of the Wells rural district to supply portions of the Shepton Mallet and Wincanton districts, and eastwards from the Shepton Mallet into the Wells district. The history of this case is as follows: Many years ago, a report was presented to the Wells Sanitary Authority as to the possibility of serving Baltonsborough and adjoining parishes from springs situated at A; but owing to the expensive nature of the scheme with reference to the population supplied, it was dropped. In 1890, the Shepton Mallet Authority wishing to supply West Bradley and parts of East Pennard, negotiated with the owners of land at A, obtained from them rights, and carried out a scheme terminating at B. In 1897, the owner of considerable property in Hornblotton and Alford, having made a provisional agreement with the owners of further land near A to take water therefrom, approached the Shepton Mallet Council (who were in want of further water) and entered into an agreement with them, to the following effect: On his conveying to the Shepton Mallet reservoir at A certain springs, he should be supplied at B with a certain fixed quantity of water. This agreement completed, the owner referred to conveyed this water to Hornblotton and Alford for the use of his estate. The Wells Council finding their natural source of supply appropriated, and the position of Baltonsborough as regards water supply having become acute, were driven to purchase water which had been brought several miles from the eastwards by the Shepton Mallet Council; while the parish of West Pennard, although having plenty of water rising within its boundaries, purchased from the Corporation of Glastonbury. The author suggests that this case fairly illustrates the haphazard methods now obtaining in dealing with available supplies of water and the needs of various districts throughout the country, and that improvement in this respect is urgently needed. Similar examples will probably occur to many members.

The Ditcheat and Baltonsborough Water Scheme

[See Plans Nos. 2 and 3.]

One of the principal peculiarities of this scheme consists



Plan No. 3.—The Levels in the Ditcheat and Baltonsborough Water Scheme.

in the fact that, whereas the total length of mains and branches exceeds 20 miles, there is no part of this length which exceeds 3 inches in diameter. At first sight, this may appear to be wrong in principle and to need some explanation. Were the author about to design a similar scheme, he would be inclined to recommend larger mains in part; but the explanation of their small diameter lies in the fact that, at the time the Ditcheat portion of the scheme was carried out, the idea of an extension to Baltonsborough had not arisen. The expensive nature of the scheme with reference to population supplied also rendered strict economy essential. A reference to the section [Plan No. 3] will show that the high elevation of the source, with the use of compensating reservoirs, situated close to the centres of supply, has rendered it possible to convey to the points where it is required, and to use without inconvenience or lack of pressure, at any point, the whole of the dry-weather flow of the available springs. It will be noted that the quantity of water which can be conveyed to the reservoir at Ditcheat (J) by the 3-inch main is 40,000 gallons per day; while the total yield of the springs in dry weather does not exceed 30,000 gallons per day. It is suggested that, in favourable circumstances, this combination of compensating reservoirs with small mains may often be advantageously adopted.

The source of supply is a spring (C), or, to be more correct, percolating underground water, which was found in very near proximity to a spring. [The latter, curiously enough, ceased to flow as soon as the percolating water had been abstracted.] The right to take water was obtained from the Earl of Ilchester, the owner of the estate; and the terms of the agreement are of interest. They provide that the Council shall give a supply to farm buildings situated 180 feet above the springs, and to other farms and lands on the course of their main, in return for a lease of a small piece of land, with water rights, for seventy years, at the nominal rent of £1 per annum, with option to renew for a further seventy years at a rent of £20 per annum. The plan adopted for supplying the high-level farm is to pass the whole of the water through a Blake's hydraulic ram, with a fall of 23 feet, by which means about 1500 gallons per day are raised to a high-level tank (D). The remainder, after passing through the ram, is conveyed to the village of Ditcheat. But the owner is entitled to use for his farms one-tenth of such remainder at any time. The Council's main passes through about two miles of the owner's land, as far as point (E), and no payment for easement was required. The cost of works exclusively for the owner's use, and in addition to the main, was £500. These terms, it is submitted, were fairly reasonable, although it may be noted that the accommodation supplied to the owner could not have been carried out by him for less than £1200.

From the point (E), where a meter is fixed on the main, the use of water by the Council commences; a few services being laid in the parish of Evercreech to outlying properties situated at some distance from the village, which is itself furnished with a separate supply. The main passes through the village of Ditcheat, serving, by itself and its branches, the principal part of the parish, before reaching the compensation reservoir at (J), whence the water passes, by a separate main, to Wraxall and Baltonsborough—thus ensuring circulation. By the opening of one connecting valve, however, the whole village may be supplied from this reservoir, if necessary. At Baltonsborough, a similar arrangement obtains; the reservoir (K) feeding only the western portion of the village, but having a connection between the inlet and outlet main by means of which the whole village may be supplied from the reservoir if necessary.

Plan No. 2 gives an idea of the lengths of branch main necessary to serve single farms, or groups of two or three houses; and it may be stated that for each house supplied an average of no less than 112 yards of cast-iron main has been laid. The cost of 3-inch main, with digging, laying, and jointing, was 3s. 3d. per yard in Ditcheat, and 3s. in Baltonsborough. Very little metalled surface had to be broken in either case, and the soil was principally an easy clay. The mains were laid 3 feet deep.

Of the total number of houses connected (which is 312), 98 are supplied through meters. This percentage (over 30 per cent.) of metered supplies is believed to be very unusual in any class of supply, and to this fact is no doubt due the very small consumption of water per head mentioned below. In Ditcheat, "Bee" meters are used, and in Baltonsborough the "Exact"—a recent modification of the "Bee." All meters are fixed in brick chambers, with galvanized covers sufficiently large to allow of the removal of a meter and the substitution of another without breaking the ground. The cottages in Ditcheat are almost entirely supplied by standposts, with anti-freezing valves, which the author has found to answer very successfully. In Baltonsborough, the services are generally carried into the houses.

Appended are further details.

Referring to Ditcheat only.

April, 1905, to April, 1906.

	Gallons.
Average quantity consumed per day	6743
Average quantity consumed per day per head, including all trade purposes	10·37
Consumed per day by two consumers for trade purposes only	2300
Consumed per day for domestic, farm, and ordinary trade purposes through meter	2073
Do., do., per head	12
Average quantity consumed through meters at farms per day	64
Average quantity consumed through meters in small supplies per day	25
Actual cost per 1000 gallons to consumers in case of larger trade supplies	1s. 5d.
Do., do., to farms	3s.
Do., do., small consumers	3s. 10½d.
Quantity consumed per head per day through standposts	5·25

Referring to the Whole Scheme.

Population supplied	1253
No. of houses ,,	312
,, ,, by meter	98
,, ,, under £8 annual rateable value	191
,, ,, above £8 without meter	21
Meters with minimum charge of 15s. per half year	44
Average minimum charge on other meters per half year	£2 3 6

TABLE A.

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Name or Parish or Scheme.	Total Area of Parishes Supplied.	Population.		Density of Population in Parishes Supplied	Capital Cost of Scheme.			Annual Cost of Repayment Loans.	Annual Working Expenses.	Annual Cost of Scheme.		Annual Revenue.		Ratio of Revenue to Cost.
		Total	Actually Supplied		Total.	Per Head of Total Population.	Per Head of Population Supplied.			Total.	Per Head Supplied.	Total.	Per Head Supplied.	
	Acres.	No.	No.	Acres per Inhabitant	£	£ s. d.	£ s. d.	£	£	£	s. d.	£	s. d.	Per Cent.
Purleigh	19,622	2,329	2,329	8·42	13,722	5 17 10	5 17 10	890	270	1160	9 11½	205	1 9	17·67
Danbury	20,892	4,060	3,300	5·12	12,347	3 2 0	3 14 9	590	250	840	5 1	565	3 5	67·26
Ditcheat and Baltonsborough (Gravitation)	6,423	1,291	1,260	4·97	9,832	7 12 3	7 16 0	526	37 (c)	563	8 11	454	7 2½	80·56
Stoke S. Michael and Holcombe (Gravitation)	2,792	1,135	875	2·46	3,400	3 0 0	3 17 9	181	21	202	4 7½	184	4 2½	91·58
Ashwick and Binegar (Partly by Oil-Engine)	3,004	1,228	538	2·44	2,717 (a)	2 4 3	5 1 0	116	43	159	5 11	112	4 2	70·42
Doulting (Wind-Engine)	3,522	695	240	5·07	1,540	2 4 4	6 8 4	78	22	100	8 4	91	7 7	91·00
Emborough (b) (Oil-Engine)	1,877	168	168	11·17	1,700	10 2 4	10 2 4	91	38	129	15 4	97	11 6½	75·20

(a) Loan only £2200, the remainder subscribed by owners, and free supply given. This makes Columns 12 and 14 lower than they would be if whole scheme had been carried out by loan.
(b) This small scheme not yet carried out but all arrangements are made, and it is given for comparison.
(c) Includes collection of revenue, but not general engineering supervision in all cases below this point.

TABLE B.—*Scale of Charges for Water by Meter.*

Note.—Meters read half-yearly, on or about March 1 and Sept. 1.

	£	s.	d.
5000 gallons per half year or under	0	15	0
Intermediate, at 2s. 6d. per 1000 gallons.			
10,000 gallons per half year	1	7	6
Intermediate, at 2s. per 1000 gallons.			
20,000 gallons per half year	2	7	6
Intermediate, at 1s. 10d. per 1000 gallons.			
35,000 gallons per half year	3	15	0
Intermediate, at 1s. 8d. per 1000 gallons.			
50,000 gallons per half year	5	0	0
Intermediate, at 1s. 6d. per 1000 gallons.			
100,000 gallons per half year	8	15	0
Intermediate, at 1s. 3d. per 1000 gallons.			
200,000 gallons per half year	15	0	0
All above 200,000 gallons per half year, 1s. per 1000 gallons.			

Discussion.

The PRESIDENT, in inviting discussion, said the heartiest thanks of the members were due to both of the authors for bringing before the meeting papers of such interest.

Mr. C. E. JONES (London) said that, if he were inclined to be hypercritical, he should rather object to Dr. Wilson's remarks with regard to some of the waters that he called polluted. What was pollution? Pollution had yet to be defined; and really a great deal too much was made of this, with the effect of frightening the British public. If waters contained pollution to the extent he had heard described on several occasions, the wonder was that any man existed. The human race would have been "improved" off the face of the earth centuries ago. Dr. Wilson certainly showed the members at a glance, the considerable difficulty that surrounded this question of water supply, particularly in rural districts. He (Mr. Jones) agreed that it was a very bad sign of the times that there were some authorities who appeared to rejoice in a dog-in-the-manger policy, and, because they were the more powerful bodies, refused to help their weaker brethren. In times past, he had advocated the placing of the water supply of these islands in the hands of a National Board, which should be irremovable, and not dependent upon the volatile vote of popularity for office. The papers to which the members had listened fortified his belief in this remedy; and until something of the kind was adopted, they would be always swimming about in this labyrinth of legal difficulty and danger with regard to water supply. He failed to see why, for instance, a man should go to the top of a high hill, and build for himself, or else for purposes of speculation, a house there, and because the water for the supply of this house was of an expensive character, that he should be allowed to call upon the ratepayers to assist him pecuniarily in his venture. It was the man who built in such inaccessible places who had to be blamed, and not the existing law. Turning to another point, it was quite common to talk of water supply at so many gallons (usually 25 gallons and upwards) per head of the population. Of course, that meant the average. But it was after all a delusive term at the best; there being very little water actally *used* per head for domestic pnrposes, if only it was properly applied. It was the water that was *wasted* that was the serious condition. Many years ago he supplied an industrial neighbourhood with water, and thoroughly satisfactorily, on 7 gallons per head of the population per day. But he saw he was left out in the cold on this occasion, as Mr. Phelps told them that 5 to 6 gallons were quite enough. He thought Mr. Phelps was right. The great cry for water to waste was a mistake; and an Association like theirs should endeavour to inform the public that it was a woful mistake which would lead to the burdening of the rates of the country to an unbearable extent. Regarding the charges for water, he did not think the minimum insisted upon by Mr. Phelps was at all too high. That there should be a minimum went without saying. He daresay the time would come when this question would be more satisfactorily dealt with, and a conclusion arrived at which would enable them to do justice all round. In his opinion, the only bodies who could do this would be Water Boards. The country should be divided into watersheds—probably ten or a dozen; but by no means should they be controlled by the County Councils, because the boundaries of counties were artificial, and liable to frequent alteration, and were not coterminous with watersheds. What was really wanted was some Central Board to deal with a watershed as a whole, and with one powerful brush to sweep away the pettifogging interests which were an obstruction rather than otherwise. Until this was done, he had little hope of the water supply of the country being conducted on a proper basis.

Mr. C. FOX-STRANGWAYS, F.G.S. (London), said, as his knowledge was chiefly in geological matters, he should only direct his attention to the first of the two papers. Dr. Mitchell Wilson alluded to the water supply of two districts—that of the West Riding of Yorkshire, and that of the chalk area to the east. In speaking of the water supply of these two areas, the author alluded to the geological formations—the trias in one case, composed of the bunter and keuper; and the chalk with the covering of drift in the other case—in fact, they were both covered with drift. In relation to the water supply of these two areas, they had two sources of water supply as it were—that from the superficial beds, the drift sand and boulder clay, and that from the underlying rocks below. As Dr. Wilson had said, the supply from the upper of these was of a very doubtful character. It was near the surface; and it was liable to be contaminated from all sorts of superficial impurity. Below that was the trias, consisting of the bunter and keuper, which in Yorkshire were not so distinct as in other counties; and it was doubtful if it was really possible to divide one from the other. In the lower part, they had a great series of sandstones, which gradually passed into the more marly measures until they became true keuper marls. The water drawn from these measures, as Dr. Wilson had said, was, in many parts of England, one of their best supplies; but, as a rule, over a large part of Yorkshire, this did not appear to be the case. Especially in the eastern part of the Vale of York, they had an instance where the water drawn from these sources was not of a nature that was suitable for purposes of water supply. The reason for this was, to a very great extent, doubtful. The water was very hard; and that hardness, they knew, came from the sulphate of lime contained in these beds. But beyond that there was a certain amount of impurity, which, so far as he knew, had not been yet accounted for. The same was very much the case with the water drawn from the chalk below the great covering of boulder clay in Holderness. The chalk occurred at a great depth, and was covered by impervious clays. Chalk water was one of the finest water supplies they had; but when the water was drawn from below this great covering, this was found not to be the case. What was the reason of this? Why was this water different when gathered from below this great sheet of clay from what it was when drawn from the springs issuing from the chalk itself. It was well known that, at the edge of the chalk, copious springs existed; and when tapped near the sources of these springs, the water was very good, as witness the supply of Hull and Beverley. In that region the water was all right; but when they got farther east in the county, more properly called Holderness, the water was not of the same character. It appeared to be water-logged, or deficient in oxidation, and was not of the character of the water issuing from the chalk.

Mr. J. DEWHIRST (Chelmsford) said that, for the past twelve years, he had been interested in the water supply of rural districts—more particularly during the last seven years in the eastern county of Essex, which probably, with one exception, was about the worst county in the United Kingdom in which one could be situated for getting a supply of water. Dr. Wilson had just placed before them, in a very concise manner, the many difficulties which rural districts had to contend with, in order to obtain a proper supply of water. Rural districts seemed to be so hedged round by local authorities, and also in regard to their spending powers, that it was almost impossible to get a supply of water at reasonable cost—that was, where villages were scattered, and not large in population. The Chelmsford Rural District Council had spent very considerable sums of money in providing a water supply for their area. They had now several pumping stations, and were making further extensions; and they had more than 50 miles of mains. This had, in many instances, led to rather heavy rates. But he was very glad to say they were now able to work the districts with a constant supply at much less annual cost than was done some years ago when the supply was intermittent. They had in one district increased their consumers by some 25 per cent., and decreased the consumption by 25 per cent. In all rural districts, it was of the utmost importance to have efficient supervision. It was a very difficult matter he knew. They had to keep down expenses, and could not afford a staff of inspectors and elaborate machinery for detecting

waste as could the large authorities. But still some supervision and expense were necessary; and so far as his experience had gone, he had found that, to have as much inspection and checking of waste as possible, paid very well indeed. It had been stated that it was not the actual consumption in rural districts that caused trouble, but the waste; and it was surprising how much waste could be checked by the visits of inspectors at varying periods. If waste was found, they had to deal with it rather sharply. As he had said, Essex was one of the worst counties in which to obtain water. They had had to build some expensive works recently in certain of the larger districts. In one case, they had to make a borehole 800 feet deep. This was rather a big undertaking for a rural authority; but it had worked out all right so far as the supply of water was concerned. In the case of local authorities who were also the water authorities, it ought to be a point with them to look after all existing public sources of supply. He found by experience in some hamlets that the public well, if properly looked after, met a want that was very much felt in some rural districts, where one or two wells properly constructed and protected answered the demands of the hamlet or group of cottages at a smaller cost than would be involved in grouping together several districts by means of mains and reservoirs. In his own district, the local authority had exercised their powers of control over the whole of the public wells; and, as fast as possible, they were improving them. If there were any signs of surface pollution, they took down the wall, as far as was necessary, rebuilt the brickwork in cement, and covered the top over with concrete for some few yards round, so keeping from the well any impure water. By this means, they had improved, and in many cases restored, the original purity of wells that had been contaminated. He felt greatly indebted to Dr. Wilson for many points in his paper. It afforded plenty of material for consideration and thought. Mr. Phelps had mentioned his (Mr. Dewhirst's) name in connection with the paper read by himself and Mr. Keywood. The Purleigh scheme referred to was by Mr. Keywood entirely; and he (Mr. Dewhirst) thought that gentlemen might have something to say with regard to Table A, which certainly showed Purleigh in a very bad light indeed. With regard to the system for Danbury and other parishes, which was a scheme for supplying seven parishes under his own control, it had been constantly extended and improved during the last seven years; and the ratio of revenue to cost was certainly much better now than it was when the figures were given. With regard to water charges, he was not sure that Mr. Phelps was quite right to have such heavy charges for trade supplies. If he (Mr. Dewhirst) was a manufacturer or farmer, he should look very carefully at some of these figures before he took advantage of them. He thought 3s. per 1000 gallons was excessive, even for trade purposes, unless the supply was of a temporary nature. With regard to Table A, there were some of the figures that were not comparable. Take the column "Ratio of Revenue to Cost," as an example. Some of the schemes were purely gravitating; while with others naturally there was a lot of pumping to be done. Then again, as to the prices given, he saw that, in one of the schemes, the water was obtained by agreement with the owner, at one rate of payment for 70 years, and then at another rate of payment for 70 years afterwards—the agreement including the supply of water to certain properties free of cost. He was strongly of opinion that it was to the best interests of the authorities to buy out-and-out the sources of their water supplies, and to avoid, as far as possible, any arrangement by which they had to give a free supply to anybody. This was working very hard in one of the schemes in the Chelmsford district, in connection with which they had to give a free supply to certain farms. This had led him to the conclusion that the local authorities ought, where they could, to buy up all lands on which they concentrated their works. If the source of supply was from springs, they ought certainly to purchase the springs and an area of land around. In Mr. Phelps's case, they did not have to pay for land and water rights; consequently the capital cost was much lower than schemes where they did so. For these various reasons, the figures in the table were not, in his opinion, comparable.

Mr. E. J. Silcock (Leeds) said the question dealt with in the papers was one of extreme importance to the country generally; and he thought it could be emphasized by saying that taking them all round, he concluded the districts referred to by Dr. Wilson were not so badly off as many other parts of the country. Dr. Wilson had had large experience in the county of Yorkshire; but, generally speaking, in his (Mr. Silcock's) experience, the village supplies in Yorkshire were not so difficult to provied as they were in Lincolnshire, Cambridgeshire, Norfolk, Suffolk, and Essex. But, undoubtedly, the difficulty was a great one in every county; and a case in point was that already referred to by Mr. Fox-Strangways—the Holderness district, which was in Dr. Wilson's county. Mr. Fox-Strangways had anticipated some of the points he (Mr. Silcock) was going to raise; and he hoped Dr. Wilson would, in his reply, throw some light on the condition of the water under the drift in the Holderness area. It would also be useful to have his experience with regard to the effect of drinking the hard water from magnesium limestone. There was a large tract of the district over which Dr. Wilson formerly had control which was on magnesium limestone; and one would be glad to know his views as to the effect of the water from this formation upon the health of the community. After all, the supply of villages was chiefly a question of the cost of a scheme; and to that they must, as engineers, direct their attention. The quantity of water that was consumed by rural populations had by one or other of the speakers been stated as 5, 6, or 7 gallons per head per day. Those quantities to engineers supplying large towns appeared to be unusually small, and altogether inadequate. But that they were not so was perfectly clear to those who had had these small village supplies in hand, because there were plenty of cases where the consumption was actually less than the figures given. He remembered a case near York where the supply was measured through a meter; and he believed that there the average consumption worked out to something under 2 gallons per head. That supply no doubt was sufficient. At all events, the inhabitants were able to make it do. If one had to design works, he did not suggest they should be content to only afford 2 gallons per head; but in dealing with the quantity of water required, one must abandon the idea that (say) 20 gallons or even 15 gallons per head were required. It could be done for much less. This was important as affecting the size of the mains; and the size of the mains usually in these scattered districts was the ruling factor of cost. The question of pumping was also a very important one, as the wages of an attendant formed an unduly large item in the total cost. He was glad to see from Dr. Wilson's paper that satisfactory results had been obtained by a scheme in which windmills were used for pumping. He had adopted windmill pumping in one or two cases for small scattered districts. It was by far the cheapest method of pumping; and it had worked out in a satisfactory sort of way as an auxiliary source of power. He thought the adoption of wind power would be more largely resorted to in future, and that it would perhaps enable some schemes to be carried out which would otherwise be impracticable on the ground of cost.

Mr. H. Hall (Montrose) remarked that he was much interested in the papers, inasmuch as they followed the President's own views as to having Water Boards. He himself thought that, until they had such Boards, and these small places were put under control, they would never get good work in rural supplies. Another thing he would point out was that they would never get good results until the existing law was altered. The law in England did not give them a sufficiently wide field. In Scotland, the law gave greater powers to County Councils to deal with this question. There a County Council had the power to call upon any local authority to supply a district. In his own case, near Montrose, there was a district known as the Hillside district, which was formerly supplied by wells. There were only about 75 houses there. They asked the Town Council if they would supply them; and they were now giving the houses a wholesome supply at the rate of 4d. per 1000 gallons. Another thing that wanted altering was the incidence of taxation. In England, the whole of the occupiers had to bear the brunt of the cost. In Scotland, it was thrown equally upon the owners and occupiers, which was, of course, fair, and made it much easier for the occupier. Many schemes were consequently entered into which would otherwise be missed.

Mr. H. Preston (Grantham) said that in Dr. Wilson's paper they were told that the water supply of rural districts was a most urgent question. He (Mr. Preston) thought that the importance was growing daily. The influx of cycles, motor cars, and railway lists of country houses ready to receive visitors, were all increasing the number of people in

rural districts, who ran the greatest risks from impure water. It might be that individuals who had been brought up on a polluted water felt, or at least knew of, no serious defect in their health by drinking such water; yet a visitor might at once be poisoned by drinking it. Such considerations certainly made the question an urgent one. The sinking of deep wells or borings for rural supplies, and rain-water supplies, were two very important considerations. In Lincolnshire, they had a most varied geological subsoil, which affected the water-supply very considerably. In certain districts, excellent artesian supplies could be obtained by merely putting a hole through some 90 or 100 feet of limestone; while in other localities an underground supply was a practical impossibility. They had scores of square miles of cold clay lands whose only supply was from surface wells—often of the most polluted character, and others again where, if a boring was made, and a small quantity of water tapped, it was generally unfit for use, containing 200 or 300 grains of common salt to the gallon. He referred particularly to certain sections of the lower lias districts. The adoption of some simple and efficient rain-water system of supply in these districts was of great importance. There were, however, extensive districts where the underground waters were still improved. He meant those large areas covered by great clay deposits and drift, in many of which, geologically speaking, there was every probability of gaining a good supply by boring to water-bearing strata. The cost of such a boring, when it reached (say) 300 or 400 feet, was great, particularly when it had to be borne by an individual owner, or was for a single farm. He would ask whether some assistance could not be given in such special cases. Only that week, he had received particulars of a boring on a farm in Mid-Lincolnshire, which had been stopped at a depth of 358 feet in Oxford clay. Here there seemed to be every probability that water would be found by continuing the boring to the lower oolites, which, from samples of the boring *débris* sent to him, he thought could not be far off. But the owner had stopped the boring because of expense; and now no one was any the wiser or better off for the expenditure on this deep boring. The idea had occurred to him that one or other of our public bodies might take up a case like this, and complete it for the public good. If water were found, others in the district might share the good fortune, or at least would know what was needed to get a supply. If the experiment proved an undoubted failure, the knowledge would at least save fruitless expenditure in the future, which would be a public good. One other point he might mention. Sufficient care was not taken to keep records of wells and borings made in our rural districts. If members of the Association would bear in mind that all records of borings and wells were gladly received and published by the Geological Survey, and send up such records as came to their notice, they would be helping to improve the knowledge of rural water supplies.

Mr. James Lees (Tonbridge) said he was specially interested in the paper read by Dr. Wilson. Twenty years ago, Dr. Wilson and himself were associated—respectively as Medical Officer of Health for Goole and Gas and Water Engineer. Since that time Dr. Wilson's experience, like his own, had greatly increased. He should like to ask one question which he had no doubt the Doctor would be able to answer for the benefit of the members. When he was at Goole, they had a well 60 feet below the surface, yielding a tolerably good supply of moderately hard water. After he left the district, the Council bought both undertakings from the Company. Some years later, a Pulp Company constructed works near the pumping-station; and they sunk their well close to the original well belonging to the Water Company. The new well went down to a considerably greater depth than the Water Company's well; and he supposed the Pulp Company took some of the water that should have been for the benefit of the town. Acting on advice, the Council went beyond the depth of the well of the Pulp Company—they went to the extent, in fact, of 1000 feet; and they got water which was enormously hard. It was some 45° of hardness, and was unfit for public use. This caused a considerable amount of public expense. Perhaps the Doctor could inform them why it was that in going to the 1000 feet, the Council obtained water of such great hardness and unfit for use. The Council had had to bear the cost of getting a new supply from another district. Doctor Wilson's information from the West Riding of Yorkshire might be of service in explaining how it was that the water supply of Goole was now very different from what it was twenty years ago.

Mr. C. H. Priestley (Cardiff) remarked that there were only one or two points in the papers which he thought affected works such as those over which he had control. To one matter in Dr. Wilson's paper, he rather took exception. It was this "that every authority who obtains water from any given district" should be required "to supply the local authorities on the line of their mains with water on reasonable conditions." In the large cities and towns of this country, with water supplies brought from a distance, the authorities were already mulcted in very heavy cost in providing compensation water to streams from which water was taken. If in taking water from a distance, through a number of small towns and villages, the city or town taking that water were bound to give a supply at a reasonable cost, it would very often make such large schemes impossible. With the proposition that a town taking water from a watershed should supply that watershed itself if necessary, he quite agreed. In a case like his own, where they brought water 35 miles, he could not agree that every place on that 35 miles should be supplied. With regard to Mr. Phelps's paper, he thought the author had given a very interesting epitome of the work in rural districts. He also agreed with what Mr. Silcock had said as to the small quantity of water that rural districts required. In his own case, there were one or two districts using at the present time only 5 or 6 gallons per head per day; and, in the poorer parts of the town, where no baths were in use, but where they were supplied with water-closets, often the consumption there was only 5 or 6 gallons per head. The whole supply of water to the town only averaged 15 to 16 gallons per head for domestic purposes. This, with proper supervision, was quite sufficient for general use. He thought Mr. Phelps was right in putting water-meters on to farms. He (Mr. Priestley) knew from experience that farms might use a very large quantity of water; and now they always insisted upon buildings, with farms attached, being supplied by meter. In connection with meter supplies, Mr. Phelps said the charge should be payable half-yearly. A half year was a long time between the taking of the meters; and many meters, as they knew, often failed to register during that time. A quarter was the limit of time in which a meter should be read. He did not know whether Mr. Phelps was aware that in Glamorganshire the County Council had this year a Bill in Parliament to empower them to do what he proposed that a County Council should do. Although he (Mr. Priestley) agreed with Mr. Jones that a national system would be the best, still he thought some use might be made of existing corporations and other public bodies. It seemed to him that a national system was in the distant future. On the other hand, County Councils had before them immediate possibilities of improving the water supply in their districts; and he thought they were perhaps the bodies who might at once be entrusted with such work. The powers that had been given by Parliament this session to the Glamorgan County Council were somewhat analogous to those which he understood Mr. Hall said were held by the County Councils in Scotland.

Mr. H. Ashton Hill (South Staffordshire Water Company) observed that he did not think anything had been said about the powers that rural district councils and local authorities generally possessed, under the Parish Councils Act, of getting a supply of water in their district from neighbouring companies or other water-supplying authorities. In his own case, he had to deal with several rural district councils; with whom they had entered into a 10 per cent. agreement, which worked admirably. A local authority would make application for a supply to some outlying village, and ask the Water Company to quote terms for a supply. The capital cost in one case came out to £2500 for laying about 6 or 7 miles of mains, and the local authority undertook to pay £250 a year on that agreement. The Company had a large number of these agreements with the different local authorities; and, as a rule, they found that, in the course of a few years, they worked themselves out, owing to the increase of population. This seemed one of the easiest possible ways of dealing with this question. The Company not only supplied rural district authorities within their parliamentary area of supply, but they had extended the supply to rural districts outside their area. There was also the point about residents of cities and towns going into rural districts, and being affected by the water there. When he

first entered upon the engineership of the South Staffordshire Water-Works Company, he took lodgings in farm-houses, in order to make himself better acquainted with the district than was possible by working from Birmingham. He took the precaution of sending for a sample of water from the wells supplying the farm-houses; and in several cases, the water was condemned by his chemical assistant. Of course, the people who were drinking it were quite accustomed to it; and it was more or less innocuous. But a person going from a city predisposed to disease might be injuriously affected. There was a case in which a Parish Council sent a deputation to the Company to know upon what terms they would supply them; and the medical gentleman who accompanied the deputation spoke of the terrible state of the wells in their district, which were said to be absolutely unsuited for use. He (Mr. Hill) asked the Medical Officer what was the death-rate; and his answer was nine per 1000—and that drinking water from these very polluted wells! This showed that such things as had been mentioned really did exist.

Mr. Lees asked Mr. Hill if he supplied the areas outside his boundary with water in bulk, or in the ordinary way.

Mr. Ashton Hill replied that they had adopted both methods. He was rather inclined not to supply in bulk, but to take a place as though it were part of the Company's parliamentary area. He thought this was the most satisfactory method.

The President congratulated the two authors upon the discussion their papers had brought forth. With regard to village water supplies, he (the President) had been connected with those of nearly all the villages round about Scarborough, independent of his borough appointment. Scalby, on the north, was a residential village for which 5, 10, or 15 gallons per head per day was insufficient, if they took the normal population; and, of course, the summer population was double that of the normal. Scalby had become a sanitary place, with baths and water-closets, and, in addition, many people there had carriages and horses. In the private houses, a lot of water was used there for this kind of thing and garden watering. The water supplied to Scalby was obtained from Lord Derwent's estate; and the whole was paid for by meter. This was not altogether a satisfactory arrangement, because when they wanted to keep the water-mains clean and flush them well, they had to pay through the meter for the water required for the purpose. This was detrimental to a pure supply. Then there were the two Aytons. These two communities wished to have a water supply a little time ago. They applied separately to the Local Government Board; but the Board said: "You must come together, or not at all." They had now a very nice gravitation supply; and the Earl of Londesborough treated them well. Another of the water supplies with which he (the President) was connected was for the villages of Folkton, Flixton, and Flotmanby. For pumping the water from a well and borehole in the chalk, a windmill had been adopted. The charges for water there were by rate; all the land being rated for water supply. Both at Ayton, and for the windmill supply, the rate was only 2s. in the pound; and a quarter of that for the rate on land. Regarding the tables in Mr. Phelps's paper, a column for trade purposes, so that a deduction could be made for that from domestic purposes, would have made the paper even more valuable. By this means, they would have been able to get nearer to the real state of the case. The table was incomplete; but it was valuable so far as it went.

Dr. Mitchell Wilson in reply, sincerely thanked the members for the kind way which they had received his paper. He hoped that the result of the discussion might be, if not in the immediate future at least bye-and-bye, that more wholesome supplies of water in rural districts might be obtained through the influence of those present at the meeting. Mr. Jones gave the meeting a very graphic description of the possible terrible cost that the rural authority might have to incur by some gentleman deciding to build houses in a situation away from any available water supply. The idea that the houses could be erected, and then a call made upon the sanitary authority to provide the water, was a fallacious one; for under the Public Health (Water) Act, in a rural district the sanitary authority would have to inform the owner of the said houses that he must provide them with water before they could be occupied. It was the neglect of this duty by the sanitary authorities that too often caused trouble of the imaginary kind referred to by Mr. Jones; and the sanitary authorities throughout the country would do well to insist on that part of the Act being carried out. He had been much interested in the remarks of Mr. Dewhirst as to the steps taken for the supply of rural districts in Essex; and the various methods adopted there agreed with his own experience in some parts of Yorkshire. The details of the schemes described by Mr. Dewhirst ought to be, and would no doubt prove, useful guides to those who were contemplating schemes for the supply of small villages. Mr. Dewhirst's experience and his own agreed, that very often sinking one or more deep wells sufficed to give a fairly adequate supply for a small village or hamlet. There was the disadvantage that the people had to carry the water for some distance, but that was only a very trifling matter when compared with the risk they ran by using water from private wells polluted from drains, closets, or ashpits, either on their own or near neighbours' premises. Regarding the question of low death rates in some districts where an impure water was known to be used, no one would be likely to accept the theory that the lowness of the death-rate was in consequence of the bad water; but it was rather due to migratory changes of young people from the district, and that those left had acquired from long usage some degree of tolerance of, or immunity from, the bad effects of the polluted water. This view was rather confirmed by the experience of visitors to Egypt. On first drinking the water from the River Nile, it was said they were almost invariably attacked with acute diarrhœa, which, when the attack had passed through, left them not susceptible to future attacks of that trouble from the same cause. Mr. Silcock's inquiry as to the effect of water from the magnesium limestone upon health, could not be answered quite definitely. He had considered the matter for a good many years over a wide district where the magnesium limestone prevailed; but neither from the local death returns, nor from those of hospitals near, had he been able to find that there was any undue prevalence of stone in the bladder. He was rather disposed to think that the use of magnesium limestone water, containing as it did, large amounts of sulphates of lime and magnesia, was most likely to disturb the digestive organs, and to cause irritation there rather than to produce troubles of the bladder. The suggestion that had been made by Mr. Phelps, that County Councils should be compelled by Act of Parliament to collect and tabulate all the facts about the water supply of their county, he would be disposed to look upon as unnecessary; for the relation between the water supply of any given county and the health of the population was so important and far-reaching that it naturally occurred to the County Medical Officer of Health that information on the subject was one essential to the proper performance of his work. He referred to the valuable work carried out in this direction by Dr. Thresh, the County Medical Officer of Health of Essex and by Dr. Seaton for Surrey, and he (Dr. Wilson), throughout the East Riding, had made it one of his first duties to collect from personal investigation the facts regarding the water supplies all over the area. The inquiry by Mr. Lees as to the great changes which took place in the character of the well water of the previous Goole supply when the well was deepened, was not easily answered in a positive way; but it was thought that the bore had been driven through the upper layers of the sandstone into the strata composed of marls from which the water was usually inferior to that from the sandstone. Regarding the practice of rural authorities in obtaining supplies of water from some parts of their districts from neighbouring authorities, he had always considered it a very desirable proceeding, and in the great majority of cases where such an arrangement had been successfully carried out, there had been little difficulty experienced in agreeing on a reasonable price, or on suitable regulations.

Mr. Phelps, in reply, first thanked the members for the way they had received his modest effort. Regarding the table, he said he was well aware of its imperfections. He should have been very glad to have added a column which would have made some distinction between the amount received for trade and domestic purposes. But, as the President was no doubt aware, this distinction was not yet drawn definitely. Under existing legislation, it was very difficult to draw it; and, in practical working, it was impossible, especially where, as in the case of the farms referred to, the domestic and trade supplies went through the same meter and the same service. Roughly speaking, the greater bulk of the water was for trade purposes in the rural districts to which he had alluded. On the point raised by Dr. Wilson

and Mr. Dewhirst, he thought that undue importance had been attached to the isolated well. He quite agreed there were circumstances in which the isolated well might be useful from the sanitary point of view. But he wished distinctly to point out that the central idea of his paper was rather in opposition to the isolated well. His idea of the way in which they should get a good supply for cottagers was rather by developing the supply for trade purposes in rural districts. The supplies to which he had been referring would never have been carried out from the sanitary point of view, had it not been for the recognition of the needs of the dairy farmers. Respecting the central control of water supplies, he was much obliged to Mr. Priestley for supporting his idea that the County Councils should do a great deal in this matter. But with reference to Dr. Wilson's remarks, he was afraid County Councils were not very easily impressed. The fact that Dr. Wilson, Dr. Thresh, and others had impressed County Councils was probably due more to the personal energy and ability of those gentlemen than to anything else, and the fact that they had done so with good results was rather a reason why County Councils throughout the country should be bound to do what these more enlightened County Councils had done. Because a parish happened to be situated in a county that had not a good medical officer (in Somerset they had not one at all), he thought it a pity that the parish should be left in want of gas and water. As to Mr. Dewhirst's remarks with reference to these charges, that gentleman thought it doubtful whether they should make such a high charge for trade purposes. He might say the farmers paid it without grudging, although they might not always pay it without grumbling. They were pleased to have it at the price; and it did not really amount to a large sum comparatively. Where a farm was rented at £200 to £250 a year, perhaps the farmer had to pay £7 or £8 for water. He had had it said to him over and over again, "I would not be without the water for £50." The charges were not by any means too high under the particular circumstances with which he was dealing. Mr. Dewhirst also objected that he had not taken into consideration in the table the difference between gravitation and pumping schemes. Mr. Dewhirst, on further reference, would see that this had been done. He (Mr. Phelps) had taken everything into account, as nearly as he possibly could, and had worked out the cost per head per annum. He had endeavoured to do this, taking all the circumstances into account. As regards the outright purchase of the water-bearing area, it would be seen that, if the Council had not paid in cash, they had done so in works. He quite agreed, however, that varying circumstances must always of necessity somewhat discount the value of any comparative table. Mr. Silcock had referred to the size of mains as being a great factor in the cost of village supplies. That was so. In his typical case, they had 20 miles of mains; and none were larger than 3-inch. He should not like it to go out from the Association that he had laid 20 miles of 3-inch main, unless there were some very good reasons for it. He knew of several cases where the arrangement was being carried out that Mr. Ashton Hill described. In most cases, he believed in supplying local authorities in bulk; and he did not think that local authorities had power to guarantee a 10 per cent. revenue.

Mr. Ashton Hill said he understood the Local Government Board allowed it.

The Water-Gas Plant for the Berlin Gas-Works.

The firm of Julius Pintsch, of Berlin, write, with reference to the paragraph under the above heading which appeared in the "Journal" a fortnight ago, that the present installation of water-gas plant at the Tegel station is to consist of three of Humphreys and Glasgow's twin-generator settings, of a total daily capacity of 3,500,000 cubic feet (not of about 2,800,000 cubic feet as stated). The generator-house at Tegel is being built to accommodate plant of a daily capacity of 10 million cubic feet. The water-gas settings of the four installations just awarded by the Municipality of Berlin are all of the Humphreys double superheater type, provided with deep fuel-bed generators, and a separate stack at the generators for the escape of the blast products, should it be found desirable to manufacture "blue" water gas over long periods. We learn that there was in Berlin a strong inclination towards the enrichment, by means of benzol, of a mixture, in the foul main beyond the hydraulic, of coal gas and "blue" water gas; but it was proved to the satisfaction of the works management that, notwithstanding the excessive duty on oils, an enormous saving could be made by carburetting with oil instead of benzol. Hence the decision to provide all the water-gas settings with the double superheater fixing chambers.

REGISTER OF PATENTS.

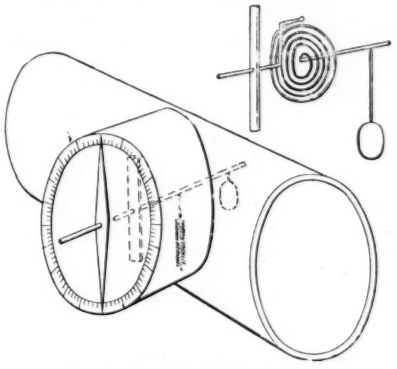
Measuring the Flow of Fluids, Gases, &c.

Atkinson, L. B., of Victoria Street, S.W.

No. 12,866; June 21, 1905.

This invention relates to apparatus for measuring the flow of lighting and heating gases, water, &c., and has for its object the placing of the measuring apparatus within the pipe conveying the fluid to be measured, while the indicating apparatus is outside. By this means "sensitive measuring mechanisms may be used, having definite and known laws of action, and causing no loss of pressure in the fluid to be measured."

The invention consists in attaching to the measuring mechanism placed within the pipe a magnet (preferably permanent), acting upon a soft iron or magnetic needle forming part of a freely suspended external indicating or recording element, or of attaching to the measuring mechanism placed within the pipe a soft iron bar or needle, acting upon a freely suspended magnet on the external indicating or recording mechanism. In certain cases, one element of the combination (either the measuring or the indicating apparatus) may carry a magnet, while the other element carries a conducting plate—the motion of the magnet causing, by electro-magnetic induction, a motion of the plate. In all cases the outside indicator follows the movement of the inside moving part.



Atkinson's Magnetic Fluid Meter.

The mechanism, as shown, measures the rate of flow at any given moment by means of a vane, small in dimensions compared with the diameter of the pipe in which the flow takes place, placed perpendicularly, or at a moderate angle to the direction of flow. The pressure of the flow, acting on the vane, deflects or moves it against a weight or spring, and actuates the magnet or soft iron piece, which communicates the movement to the outside indicator.

Since the pressure on the vane is, the patentee points out, proportional to the square of the velocity of the fluid flowing when the flow is rapidly varying, in order to obtain a true mean reading, it is necessary that the restraining force should be proportional to the square of the movement. This may be achieved in various ways; but one simple one is the use of a spring acting on a lever moving in an arc of a circle, so that as the tension increases from zero or a small value, the effective radius increases also, and the product approximates almost exactly to the square of the angular movement. Where the variations of flow are very rapid, so that the magnet has a periodic time too great to follow it, the moving vane may act, through an elastic connection, so that the magnet comes to the mean position without itself rapidly following the variations.

Gas-Cocks.

Ainsworth, F., of Ilford, Essex.

No. 15,914; Aug. 3, 1905.

The patentee proposes to provide within the plug of a gas-cock a number of baffle-plates, arranged preferably in such a way that they are formed in one with, or move with, the plug when the latter is turned. In combination with the baffle-plates means are employed for independently regulating the pressure of the gas—consisting of a device for determining the passage of the gas past the baffles.

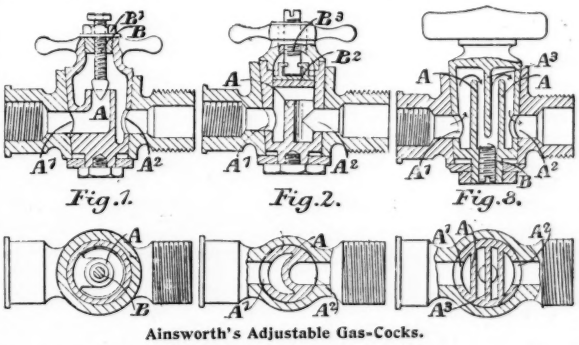


Fig. 1. Fig. 2. Fig. 3.

Ainsworth's Adjustable Gas-Cocks.

As shown in fig. 1, the plug of the cock is provided with a baffle consisting of a central tubular part A of considerable height, the interior of which terminates at one end in an orifice A^1 on the inlet side of the plug.

and at the other end opens into the upper enlarged part of the plug, which communicates with an orifice A^2 on the other side. In conjunction with the baffle, means exist for regulating the passage of the gas past the baffle—consisting of a screw B adapted to be moved towards or from the baffle, and to be locked in its adjusted position by a nut B^2. The plug may be turned (say) by two arms, as shown.

Fig. 2 illustrates another arrangement of baffle. In this case, it consists of a transverse curved plate A, projecting upwards from the base of the plug, and arranged intermediate between the orifices A^1 A^2; while the regulating means consists of a disc B^2 adapted to be moved towards or from the baffle A by turning the screw B^3.

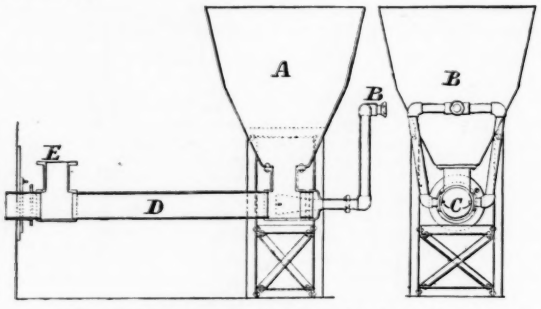
Fig. 3 illustrates another form the invention may assume. According to this arrangement, the plug has two transverse baffle-plates A extending upwards from the bottom of the plug to within a short distance of the crown of the plug and on either side of a third baffle-plate A^3 depending from the crown. The orifices A^1 and A^2, on opposite sides of the plug, open into the spaces on the outer sides of the baffle-plates. In this case, the regulating means may consist of a screw B engaging with a tubular extension of the plug, and adjustable with respect to the baffle A^3.

Charging Gas-Retorts by Steam-Jets.

SHAW, I., of Darlington, and HAYCOCK, R., of Low Moor.

No. 18,002; Sept. 6, 1905.

This invention relates to fuel-feeding and charging apparatus in which the fuel is delivered from a hopper through a horizontal tube by steam-jets.



Shaw and Haycock's Patent Charging Arrangement.

The hopper A, fitted for the supply of coal, is fixed upon a loose angle-iron stand. The steam pressure is admitted at B, and passes down the two pipes and through the nozzles C, placed at an angle of about 30°, driving the coal along the wrought-iron or steel pipe D into the retort. The other end of the pipe is open to the atmosphere.

The steam pressure is adjusted to suit requirements; and, if found necessary, a relief valve is fitted at E, "to dispense with any steam that may have a tendency to darken the fires." This applies mostly to gas-retorts.

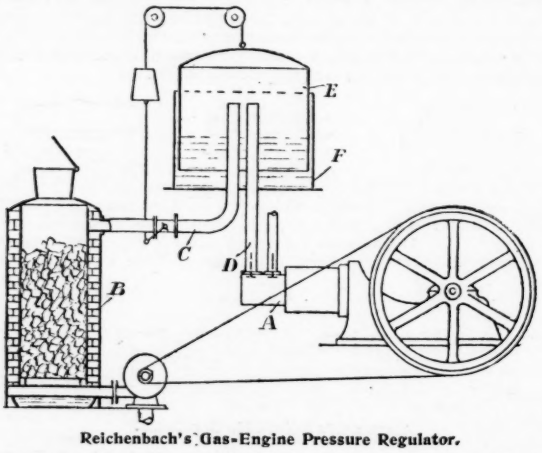
Supplying Gas to Engines.

REICHENBACH, F., of Charlottenburg, near Berlin.

No. 21,566; Oct. 23, 1905.

The object of this invention is to use in a gas-engine only gas which shall be always at atmospheric pressure; so that the gas and the combustion air required are admitted to the cylinder under the same pressure. As, however, gas produced in suction and pressure gas generators, or supplied by the gas-works, does not possess atmospheric pressure, it is necessary, the patentee points out, to make the pressure of the gas equal to that of the atmosphere on its way to the engine.

Various forms of gas-pressure regulators have been suggested—as, for instance, in patent No. 13,273 of 1902; but up to now the inventor is unaware of any device having been proposed which will maintain a supply of gas to the engine always at atmospheric pressure, whatever may be the speed of the engine, which is the object of the present invention. The process proposed is said to have the advantage over



Reichenbach's Gas-Engine Pressure Regulator.

old processes having a similar object, in that the relation of the quantity of gas drawn in by the piston to the quantity of air drawn in is not affected by the speed of the engine or of the piston drawing in air and gas. The composition and the value of the air-gas mixture, as regards quantity of gas and quantity of air, is always the same during starting, and during slow or fast running of the engine. The equality of pressure of the gas and of the air is of special importance at the starting of the engine, as during that time an insufficient quantity of gas is admitted into the cylinder in the case of suction gas generators, and an excessive quantity in the case of pressure gas generators, as compared to the quantity of air admitted at the same time, as, of course, the engine would better draw in air offering no resistance than gas from the generator. Such drawbacks cause miss-firing, due to improper proportions in the mixture of gas and air.

A device for carrying out the process according to this invention is illustrated by an engine working in connection with a generator.

A is the engine; and B the generator, in which compressed gas is produced by a fan driven by the engine. The pipe C from the generator to the engine does not lead direct to the engine, but opens into a balanced bell E immersed in a vessel F filled with water. From this bell the engine draws in gas through a pipe D. The weight of the bell is completely balanced by a weight, so that the pressure of gas in the interior of the bell is permanently equal to the atmospheric air pressure acting on the bell from the outside. The closing valve in the pipe C serves merely to regulate the quantity of gas supplied to the bell, in accordance with the quantity removed from the bell. Whether then the engine is running fast or slow, whether it is being started or running permanently, there is always in the pipe D gas of the same pressure as the combustion air admitted into the engine cylinder during the suction period.

Gas-Main Syphons.

WILTON, G., of Mark Lane, E.C., and CHAPPELL, C. J., of Bow, E.

No. 3439; Feb. 12, 1906.

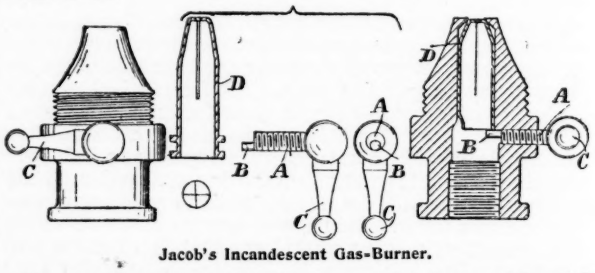
The inventors propose to form the ends of the syphon-pipe with a conical socket of suitable taper adapted to receive a correspondingly conical plug so fitted as to be easily withdrawn, but yet made of sufficient weight or such a tight fit as to secure an effective closure. They further provide the pump with a nozzle having a correspondingly tapered end adapted to be placed in the conical socket of the syphon for coupling the pump to it. This conical nozzle is also of sufficient weight or tight fit so as to secure an effective joint under suction by the gripping action of the co-acting conical surfaces.

Incandescent Gas-Burner with Flash-Light.

JACOB, C. & P., of Zwickau, Saxony.

No. 5974; March 12, 1906.

This invention has for its object to provide means for dispensing with the bye-pass, and also to regulate the supply of gas to the flame. The burner-head, is formed with an internal cone portion and fitted with an internal sliding sleeve, having a tapering and split upper end, with external means for moving the sleeve against the conical portion of the burner-head so as to cause the slits to close and only leaving a small opening for the egress of sufficient gas to keep a pilot-flame at the top of the burner.



Jacob's Incandescent Gas-Burner.

The means for operating the split sleeve consist of a stem A inserted in a lateral hole in the burner and having an eccentric stud B and an external handle C. The stud serves to move the sleeve D whose upper end is made tapering and has longitudinal cross-slits. When the stud is turned uppermost, it forces the sleeve against the conical portion of the burner-head and so causes the slits to close, but leaves a small central hole at the top for the gas to feed a pilot-flame. By reversing the position of the stud, the springiness of the split sleeve acting against the cone portion causes it to slide downward, and so allow the slits to open and permit the full supply of gas to reach the mantle. The stem is screw-threaded, and its hole in the burner is tapped so that the handle can be turned in either direction for 90° in order to operate the sleeve.

Three-Way Gas-Burner Tap.

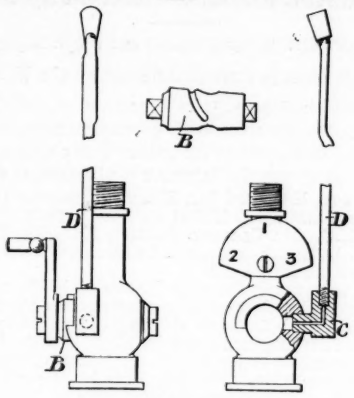
GODSON, R. S., of Paignton.

No. 6111; March 13, 1906.

This invention provides means for first opening a bye-pass for gas to flow to the igniter, then opening the passage to the main burner, and then closing the bye-pass. Means are also provided whereby a special bye-pass tap is not required, in addition to the tap for entirely cutting off the flow of gas.

The tap, as shown, is provided with an attachment or elbow piece C, leaving a small chamber between the end of the screw and the bore of the tap in which the plug B revolves. This elbow piece has a hole or passage connecting the bye-pass tube D (which is screwed into C) with the small chamber. The plug is provided with a groove commencing at a point near the lower end of the main gas passage but not connected with it, and running upwards towards the thicker end of B to a point in the rear of the upper end of the main gas passage but not connected with it. On revolving the plug by the handle towards the bye-pass

position (3), this groove takes the gas from the lower end of the main passage (before it is completely closed) and conveys it to the small chamber and so on to the bye-pass tube itself; so that when the handle rests at the bye-pass position, the groove forms a channel by which



Godson's Bye-Pass Tap.

alone gas can pass. To turn off the gas altogether the plug is revolved to the "off" position (2) in the half disc attached. The groove will then be in the upper part of the bore of the tap, where it can take no gas.

APPLICATIONS FOR LETTERS PATENT.

15,475.—HARPER, H., "Pendants and brackets." July 9.
15,663.—BARTLETT, F. G., "Bye-pass gas-taps." July 11.
15,668.—MARTIN, W. G., and HASELL, W. M., "Connections for flexible gas-tubing." July 11.
15,728.—BRAUNSTEIN, J., "Inverted burners." July 11.
15,737.—PRYCE, A. T., "Rotary pump, &c." July 11.
15,776.—MEYERSBERG, G., "Production of gas." July 12.
15,790.—KELLERMANN, J., "Igniting device for inverted gas-lamps." July 12.
15,809.—WEBBER, J., "Incandescent burners." July 12.
15,919.—CAMPBELL, V. E., "Automatic gas cut-off." July 13.
15,970.—EDGAR, W., "Street-lanterns." July 14.

PARLIAMENTARY INTELLIGENCE.

HOUSE OF LORDS.

The following further progress has been made with Bills:—

Bills read a second time and committed: South Lincolnshire Water Bill, Sutton District Water Bill.

Bills reported, with amendments: Derby Gas Bill, Pontefract Corporation Bill, Poole Corporation Water Bill, Tottenham and Edmonton Gas Bill.

Bills read the third time and passed: Bacup Corporation Bill, Rochester, Chatham, and Strood Gas Bill, Watford Gas Bill.

Bills Royal Assented: Brixham Gas (Electric Lighting) Bill, Bury Corporation Bill, Cardiff Gas Bill, Cheltenham Gas Bill, Cumberland Electricity and Power Gas Bill, Dowlais Gas Bill, Epsom and Ewell Gas Bill, Gas Companies (Removal of Sulphur Restrictions) Bill, Glamorgan and South Wales Water Bill, Huddersfield Corporation Bill, Kettering Water Bill, Manchester Corporation Bill, Merthyr Tydfil Gas Bill, Metropolitan Water Board Bill, Newport Corporation Bill, Newtownards Urban District Council Bill, Peterborough Gas Bill, South Suburban Gas Bill, Southampton Gas Bill, Sutton, Southcoates, and Drypool Gas Bill, Uxbridge Gas Bill.

Bill withdrawn: Water Provisional Order Bill [Poole Order].

Petitions in favour of the Sutton District Water Bill have been presented by the Epsom Rural District Council, the London County Council, the Provincial Water Companies' Association, and the Sutton Urban District Council; and against it by the London, Brighton, and South Coast Railway Company.

Protection of Mains from Electrolysis.

On the third reading of the Corporation of London (Blackfriars and Other Bridges) Bill on Monday last week, Lord Welby, before it was passed, moved the insertion of a new clause for the further protection of the Gas Companies and the Metropolitan Water Board. It provides that in the event of damage to their pipes from electric currents, nothing in the Bill should relieve the Corporation from liability to make compensation. The Earl of Onslow opposed the amendment on the ground that, according to precedent established in 1903, these matters were left to the regulation of the Board of Trade. Lord Newton said this particular question was perpetually arising; and it was perfectly plain that if the amendment was accepted it would cause complication in Private Bill practice, as it would create a fresh precedent. It was, in his opinion, most desirable that there should be uniformity of practice, and he would suggest that the Board of Trade should appoint a Departmental Committee, or take some similar step, in order to ascertain the actual rights in the matter, and that the decision come to should be a guidance in future to Committees of the House. Viscount Ridley suggested that the Board of Trade might at the same time inquire into their own action in granting, as they did in 1904, a Provisional Order containing the clause the noble lord now proposed. The Earl of Crewe said that, in view of the opinion expressed by the Chairman of Committees (Lord Onslow), he hoped his noble friend would not persist in trying to get the clause inserted. The amendment was then, by leave, withdrawn, and the Bill was passed.

HOUSE OF COMMONS.

The following further progress has been made with Bills:—

Lords Bills read a second time and Committed: Gas Orders Confirmation Bills (Nos. 1 and 2), Gas and Water Orders Confirmation Bill, Water Orders Confirmation Bill.

Lords Bills reported, with amendments: Crediton Gas Bill, Truro Gas Bill.

Lords Bills read the third time and passed: Cumberland Electricity and Power Gas Bill, Glamorgan and South Wales Water Bill, Portsmouth Water Bill, Wolstanton United Urban District Council Gas Bill.

TOTTENHAM AND EDMONTON GAS BILL.

By this Bill, which came before the Unopposed Bills Committee of the House of Lords last Tuesday, the Tottenham and Edmonton Gas Company seek further powers. Clause 20, with reference to raising additional capital, sets forth as follows:

The Company may raise additional capital not exceeding in the whole six hundred thousand pounds by the creation and issue of additional "A" consolidated stock or of additional "B" consolidated stock or new preference stock, or partly in one way and partly in the other; but such stock shall not vest in the person accepting the same unless and until the full price of such stock, including any premium obtained upon the sale thereof, shall have been paid in respect thereof: Provided that it shall not be lawful for the Company to create and issue, under the powers of this Act, any greater nominal amount of capital than shall be sufficient to produce, including any premium which may be obtained on the sale thereof, the sum of six hundred thousand pounds.

By clause 43 it is provided that the prescribed number of candles shall be 14; while clause 46 gives the Company power to supply gas-fittings which shall not be subject to distress. The Bill was ordered to be reported with amendments.

POOLE CORPORATION WATER BILL.

A Select Committee of the House of Lords, presided over by the Earl of Kintore, on Thursday considered the above-named Bill, the object of which is to enable the Corporation of Poole to acquire, by agreement, the Poole Water Company's undertaking. Mr. Honoratus Lloyd, K.C., and Mr. Vesey Knox appeared for the promoters; and the only petitioners against it were the Bournemouth Gas and Water Company, who were represented by the Hon. J. D. Fitzgerald, K.C., and Mr. Shaw. The authorized limits of supply of the Company embrace a part of the area known as Branksome Park, in which the Bournemouth Company have concurrent powers to supply water. The Poole Company have possessed for fifty years the right to supply in this area, but have never exercised it; the Bournemouth Company being the only one actually supplying. The latter Company therefore presented a petition with the object of obtaining the exclusion of this area from the Bill, so that they would have the sole right to supply water in the area named. On behalf of the Corporation, this proposal was objected to, on the ground that, in purchasing the undertaking of the Poole Company, they would acquire the right to supply in the Branksome area, and should not, therefore, be deprived of it. Their powers, it was urged, should be the same as those possessed by the concern they were taking over. Mr. Fitzgerald pointed out that the Poole Company had never supplied the area in question, and that it would be unfair to have the Bournemouth Company subject to possible competition by a municipal authority aided by rates to which they themselves were very large contributors. There was, moreover, little likelihood of the Poole Company ever supplying in the district, because their rates were much in excess of those of the petitioning Company. Ultimately the Committee passed the Bill, but required the limits of supply to be amended so as to exclude the area in dispute, which therefore the Bournemouth Company have now the sole right to supply.

UNOPPOSED BILLS.

The Committee of the House of Commons which deals with Unopposed Bills had a sitting last Tuesday, under the presidency of Mr. CALDWELL, the Deputy Chairman of Ways and Means, for the consideration of a group of Bills, among them being two in which our readers are interested.

Crediton Gas Bill.

In the case of this Bill, Mr. Lees, for the promoters, stated that an arrangement had been come to with the Urban District Council of Crediton, as a result of which the opposition of that authority had been withdrawn. Under the agreement, the promoters reduced the amount of their proposed additional capital from £17,000 to £14,000, limited the rate of interest on borrowed capital to 4½ per cent., and undertook not to pay a dividend of more than 5 per cent. until the price of gas had been reduced below 4s. 6d. per 1000 cubic feet. The Bill was allowed to proceed.

Truro Gas Bill.

Mr. H. BROWNE (of Messrs. Dyson and Co.), on behalf of the promoters of this Bill, stated, with reference to the Company's capital,

that their existing capital was made up of £25,000 in shares and some £8000 in 4 per cent. debentures. The Company had expended out of revenue a considerable sum on capital account, and the proposal was to make the statutory capital £60,000; but of this amount £37,500 was to be applicable in substitution for the existing £25,000. It was proposed to place the Company upon a statutory basis. The Truro Corporation were satisfied with the Bill. Gas was being supplied at 3s. 9d. per 1000 cubic feet; but the standard price was 4s. 2d.; and the illuminating power was 13 candles.

Clause 103 of the Bill provides that if at any time, within seven years from the passing of the Act, the Corporation should apply to Parliament for power to purchase the gas undertaking, the Company should not oppose the application except in so far as might be necessary to secure the insertion, in any Bill to authorize such purchase, of clauses to protect their interests. The Company are to be at liberty to petition either or both Houses of Parliament, and if such powers of purchase are granted, the Company are to sell the undertaking to the Corporation. The latter are to pay compensation to any officers and servants in the regular employment of the Company who are not retained by them. It is provided that no officer or servant who has been in the employ of the Company for ten years or upwards shall lose his right to compensation by reason of his declining to enter the service of the Corporation. The expression "the undertaking of the Company" includes all the gas-works, engines, mains, pipes, and machinery, lands and buildings, plant fixed and moveable, and other property, and all the rights, powers, and privileges vested in the Company at the date of the transfer, except the cash balances (other than consumers' deposits) in the Company's hands and in those of their bankers or agents, securities for money, all sums standing to the credit of their reserve fund, all undivided profits, and all surplus stock-in-trade and stores not in use, which may be purchased by the Corporation at a valuation in the usual way; also all rents and profits of, and all book and other debts due to, the Company, and all rates accrued due on the date of the transfer, and the books and papers relating exclusively to the shareholders in, and to the constitution of, the Company.

In reply to a comment upon this clause by Sir CHANDOS LEIGH (the Speaker's counsel),

Mr. BROWNE said there was a point with regard to the obligation upon the Corporation to take over the undertaking subject to all existing mortgages, obligations, and liabilities of the Company in respect of, or affecting, their undertaking. This obligation dealt with the £8000 of irredeemable debentures; and he would point out that the Local Government Board objected to a municipality taking over irredeemable securities. The rights of the debenture holders were to be taken into consideration by the Company; and at the present time they had security unless they wished to sell. He would be reluctant to insert anything in the Bill which would provide for compulsory redemption, or which might appear to prejudice their rights.

Mr. BOYCE, representing the Local Government Board, pointed out that for the compulsory redemption of stock there was no precedent, and the Department considered it to be inadvisable that the Corporation must buy subject to the irredeemable stock.

Lord R. CECIL (a member of the Committee) suggested that the matter should be left to the Committee on the Purchase Bill, when the Corporation brought it in.

This was accepted both by the Agent and by Mr. Anderson, a representative of the Corporation.

A discussion arose with respect to a difficulty put forward by Mr. BOYCE that there was nothing to prevent the Company from creating further irredeemable stock.

Mr. BROWNE replied that the stock already existed, and further creation was only a question of degree.

Mr. BOYCE then suggested a reduction of the purchase period—remarking that seven years was unusual.

This was objected to by Mr. Anderson.

Lord R. CECIL: As they have made these very unusual terms, I do not see how we could interfere.

The Committee decided, with reference to the words "subject to all existing mortgages, obligations, and liabilities of the Company in respect of, or affecting, their undertaking," that they should be deleted, along with the provision that the Corporation should purchase within twelve months after the passing of the Bill.

Amended in this way, the Bill was ordered to be reported.

Tynemouth Water Scheme.

An official visit has just been made to Fontburn, with the object of inspecting the progress of the reservoir works which are being undertaken there by the Tynemouth Corporation. The Corporation obtained the necessary parliamentary powers as far back as 1898; but it was not until 1901 that the first sod was cut on the reservoir site. The works have been designed by Messrs. Mansergh and Sons; the general scheme being to impound the water of the River Font in the reservoir constructed in the base of the valley, and after filtration to deliver it by means of a gravitation main into the service pipes. The only portion of the work in connection with this stupendous undertaking yet remaining to be completed, is the construction of the main embankment; and it is expected that this will be accomplished within the next eighteen months. The capacity of the reservoir when completed will be 720,000,000 gallons; and the daily supply available for Tynemouth will be 3,725,000 gallons. The estimated cost of the scheme in its entirety is about £530,000, of which something like £450,000 has already been expended. The visitors were conducted round the works by Mr. Hull, the Resident Engineer.

The Lighting of Oxford Street.—The Marylebone Borough Council last Thursday decided to erect in Oxford Street 46 pillars for the purpose of illuminating the thoroughfare with electric light. The pillars are to be 25 feet high, and the majority will be supplied with double overhanging brackets. The cost of the installation will be £1113 17s. 9d., which is £75 more than the estimate.

LEGAL INTELLIGENCE.

BRISTOL ASSIZES.—Monday, July 16.

(*Before Mr. Justice* DARLING *and a Special Jury.*)

Liability for Damage through the Bursting of a Water-Main.

This was a claim by Messrs. John Thomas, Sons, and Co., who own a sugar warehouse and are wholesale grocers carrying on business in Redcliff Street, Bristol, against the Bristol Water Company, for compensation for damage sustained through the bursting of a main.

Mr. J. A. FOOTE, K.C., and Mr. HOLMAN GREGORY (instructed by Messrs. Brittan, Livett, and Miller) appeared for the plaintiffs; Mr. H. E. DUKE, K.C., Mr. CLAVELL SALTER, K.C., Mr. D. M. KERBY, and Mr. T. W. H. INSKIP (instructed by Messrs. Gerrish, Harris, and Co.) represented the defendants.

Mr. FOOTE, in opening the case for the plaintiffs, said they had sustained considerable damage in consequence of the bursting of a water-main in Redcliff Street on the 29th of April last year. It had been agreed that the Jury would not be troubled with the amount of the damage; the only question they had to decide was whether or not the defendants were liable. The main that burst was a 24-inch iron pipe ¾-inch thick, running from the filter-beds at Barrow, some six miles off, *viâ* Bedminster Bridge, and then by Redcliff Street to another main in Victoria Street, close to Bristol Bridge. It had a junction with the Victoria Street main at the southern end of the Bridge. It was laid in 1888. Tenders were invited for 2330 pipes of a particular weight and ¾ inch thick, and 320 pipes 1 inch thick; and the specifications prescribed No. 2 cold-blast pig iron.

Mr. DUKE pointed out a slight variation. He said that the metal was to be of good tough quality, not inferior to No. 2 cold-blast pig iron.

Mr. FOOTE (continuing) said that something, though not very much, depended upon the quality of the iron. The iron supplied was "a good mixture of Staffordshire and other brands." He should not ask the Jury to say that the iron was unfit to be used in making the pipes, but to say it was not so good as No. 2 cold-blast pig iron. These pipes had, according to the specifications, to be submitted to a test—the thicker ones to a pressure of 600 feet of water, and the thinner ones to 400 feet. There was a considerable fall all the way from Barrow to Redcliff Street; and the place where the burst occurred was 251 ft. 6 in. below Barrow. One would have thought that the thicker pipes would have been placed at the end of the main, where the pressure was most severe—that was to say, in Redcliff Street, which was the lowest point of all; and also at a place where the consequences of a burst would have been likely to do most mischief. But this was not the idea. The Great Western Railway, whose line was crossed by the main, desired to make themselves secure; and in the Water Company's Act, there was a clause which provided that if injury or interruption should arise in any way owing to the bursting, leakage, or failure of any mains, pipes, or works under or near any bridge or level crossing of the Company, the Water Company should pay compensation in respect thereof. Therefore, while they had to make good to the Railway Company any damage caused by the bursting of a main, their contention seemed to be that they were not bound to compensate the public for a burst occurring in the city. Under these circumstances, it was perhaps not surprising to find defendants did not put the 320 1-inch thick pipes in Bristol, but where they ran under the railway, and where the pressure was lowest. In Redcliff Street it was two or three times as great as where the main crossed the railway. There was a stopcock at the junction with the main at Bristol Bridge, and another in the main at Ashton Gate, before Redcliff Street was reached. The latter was about 1¾ miles from the spot where the burst took place. Something turned upon this, because the water could not be shut off in Redcliff Street until a man had been sent out to Ashton Gate; and that occasioned great delay in stopping the water. At Bedminster Bridge (between Ashton Gate and the burst), there was a 7-inch wash-out from the main into the New Cut, and there was also a relief-valve; while at Redcliff Hill there was a pressure-gauge which recorded the pressure. Beyond these, there were no other openings in the main. The 24-inch main was not only connected with the one at Bristol Bridge, but was indirectly connected with the two others. Soon after the 24-inch main was laid, and while it was still under the contractor's charge, it burst. This occurred in Redcliff Street in April, 1889. In 1892 it burst again; the accident this time occurring on Redcliff Hill. In the following year a safety-valve was put in at Bedminster Bridge, where the 7-inch wash-out now stood. It was at work again in 1893; but notwithstanding this, there was another burst in October of that year.

Justice DARLING: What do you complain of to-day, the pipe or the joint bursting?

Mr. FOOTE: The pipe bursting. Proceeding, Counsel said that there was no doubt the pipe had caused a great deal of anxiety. This, so far as he knew, was the only main in the Company's many miles which had an automatic pressure-gauge; and they did not put it there without reason. It was to show when the pressure was becoming dangerous; but it would seem that the Company did not take the trouble to act upon its warnings. In December, 1893, they gave up this main as a pumping main, and only allowed the water to run through it by gravitation. This, he assumed, had been done because it was not safe to trust it. Things went on satisfactorily for some time, and in December, 1894, the Company discontinued the safety-valve. In 1901 there was another burst; but until last year there was no more trouble with the main. About two o'clock on the morning of April 29, a police-constable found that the main had burst at a point about 40 yards from the plaintiffs' warehouse; and the water flooded the street to a depth of 18 inches. The constable telephoned to the Company's premises, and afterwards found a turncock; but though he had the necessary implements, he could not turn off the water, and had to awaken a foreman. Eventually the water was shut off at Bristol Bridge at 3.25 a.m.—an hour and twenty minutes after the burst. At 3.40 a.m. the wash-out at Bedminster Bridge was opened, and some

relief was thus given; but it was not until 3.55 a.m. that the water was effectually turned off at Ashton Gate. He submitted that the Company had been grossly negligent in not having somebody who could keep a watch and turn off the water as soon as he heard of an accident. Having parliamentary powers to put down pipes and keep them in the ground, the Company were not liable for natural and ordinary consequences; but he contended that they were bound to use extreme care and the highest degree of diligence in laying their pipes and in the management of them to prevent any injury to the public. They were bound to have pipes which the most careful man would use in order to prevent, humanly speaking, the possibility of a burst; and also to have appliances to regulate the pressure, and give such warning as to enable them to diminish the flow of water when the pressure increased, and prevent injury to the public. The ordinary pressure was about 60 lbs. to the square inch; and the record showed that it was 70 lbs. when the burst took place. He thought the explanation was not only the inequality of the pressure, which told upon the main, but the suddenness with which it was applied.

The following evidence was then given in support of the claim.

Mr. *J. S. Armstrong*, a member of the plaintiffs' firm, stated that the water coming from the burst main flooded the warehouse to a depth of 17 inches; and goods were damaged to the extent of £1280.

Mr. DUKE said that, as there was no question between the parties as to the amount of damage, he would not cross-examine the witness.

Police-Constable *Evans* gave evidence as to hearing a report and discovering the leakage.

By Mr. DUKE: When he telephoned to the Company's premises, he at once received a reply from the foreman.

Herbert Wright, an engine-driver in the employ of Messrs. Perry and Co., who have a warehouse opposite that of the plaintiffs, also spoke as to the flooding of the premises.

Mr. *W. Fox* said he had visited the plaintiffs' premises, and had seen pieces of the broken pipe. He had read the specifications, and declared that the iron used in the pipes was not No. 2 cold-blast pig iron. This was more expensive than that employed; and the difference in 1888, when the pipes were made, would have been between 30 and 40 per cent. The iron used was not so tough as No. 2 cold-blast. The difference in tensile strength would be about 25 per cent. He could see no reason for laying the thicker pipes out in the country, other than that the Railway Company owned the ground there. The pressure was considerably greater in Redcliff Street than in the vicinity of the railway line. He did not consider ¾ inch was strong enough for a pipe placed where the burst occurred. He thought ⅞ inch might have been sufficient; but it would be better to have a 1-inch pipe. The stopcock ought, he considered, to have been placed nearer the city than at Ashton Gate.

Cross-examined by Mr. DUKE, witness said he had known of sound cast-iron pipe breaking by water pressure from within, but could not specify any particular place where this had occurred. He had laid several lengths of 24-inch mains, but did not remember having used pipes ¾-inch thick. The normal life of a pipe varied. He had known some last ten years and others sixty years. Evidence of a worn-out main was its being rusted and pitted when taken up. The broken pipe in question was not in any such condition. It seemed to have a life of thirty or forty years left, with reasonable pressure; and 60 lbs. or 70 lbs. was not a high pressure. The pressure on the main in Redcliff Street was neither exceptionally high nor exceptionally low. He might have suggested to plaintiffs' advisers that the iron used was not of the quality mentioned in the specification.

Mr. DUKE: Do you know that, at the time these pipes were made, no water-pipe had for a generation been made of No. 2 cold-blast pig iron?

Witness: Very likely.

It would be commercially impossible, would it not, to get water-pipes at the present day made of No. 2 cold-blast pig iron?—Of course, it would be very expensive; but I cannot say it would be commercially impossible.

Do you know any maker in England who has made water-pipes from No. 2 cold-blast pig iron in the last forty years?—I will not say forty, but not for thirty.

Mr. FOOTE: I am not complaining that the iron was not No. 2 cold-blast pig iron, but that it was something very inferior.

In further cross-examination, witness said he made no suggestion against the pipes other than that they were not thick enough.

Mr. *Togarmah Rees*, of Newport, said he examined the remaining portions of the pipe, and could not discover anything to suggest the reason for the burst. Looking at the quality of the iron, he should say the thickness was not sufficient. He should have made the pipe at least 1 inch think. He put stopcocks at every mile in the country, but much closer in the towns. Speaking generally, he agreed with the evidence of the last witness.

Cross-examined Mr. DUKE, witness said he had never had anything to do with 24-inch pipes. The largest he had laid were 15-inch; and these were 1 inch thick.

This closed the case for the plaintiffs.

Tuesday, July 17.

On the resumption of the hearing this morning,

Mr. DUKE opened the case for the defendants. He said the real question the Jury had to decide was whether or not the bursting of the pipe was owing to the negligence of the Water Company. Possibly many of them thought that, if the water escaped from the mains of a public company, the damage caused ought to be compensated for. This was not the law; and the Court was not constituted to alter it. Though it might seem a very great hardship upon individuals, where damage was done in the course of the public service, the law was that unless it was through negligence on the part of the company there was no cause of action. He mentioned this because the point had not, up to that time, been distinctly put before the Jury. What the plaintiffs had to do, if they were to succeed, was to show that the defendants were negligent with regard to the construction of the main in question, or with regard to its maintenance. Some point had been raised as to the time which had elapsed before turning off the water. This, however, was not a serious question. The point was as to the construction of the main. His learned friend had directed his attack against the main. But the main itself had never burst. What happened was that, after a period of eleven years, during which only one pipe had burst, another burst in a manner which would be described. One of the Company's foremen would tell the Jury that a part of the pipe—a piece 9 feet in length—was detached from the rest; and that it had been raised from the body of the pipe. Except that this piece had been broken off from the remainder of the pipe, the body was intact. This piece, it would be contended, was blown out by a pressure of water which was insignificant compared with that which it was constructed to bear. It was calculated to stand a pressure of 8½ tons; and the actual pressure upon the pipe at the time of the burst was not one-tenth of this. It was therefore obvious that it was not the normal strength of the iron of the pipe that gave way. The plaintiffs had seemingly cast about to see what they could allege against the defendants to endeavour to show that they were negligent; and they "boxed the compass," to use a familiar expression, in their allegations. They had been hard put to it to find something upon which to rest their case. They alleged that the main was of inferior material and of insufficient strength; that it was improperly, negligently, and unskilfully laid; and that it was not properly maintained, and was allowed to get into a bad state, and was not renewed when it was worn out. It was admitted to be a clean sample, equivalent to No. 2 pig iron, and was sound, not worn at all, was not in disrepair, and apparently had a long life as far as iron went. Then it was alleged that the water was passed along the pipe unduly; and there was the further allegation about delay in turning it off. These were the allegations which the plaintiffs made last October. On the 10th of the present month, they seemed to have some misgivings as to whether their allegations would suit, and so they said the defendants failed to put any effective relief-valves in the main in Redcliff Street, or at a reasonable distance. His learned friend's opening and Mr. Fox's evidence went to show (he did not speak in any offensive sense) that this was an action that was speculative—that was brought to find out whether an allegation of negligence somewhere could be sustained against the defendants in order to render it a cause of action. Then his learned friend suggested that there should have been more stopcocks. The position in regard to this matter was that the nearest stopcock on the Barrow side was at Ashton Gate; but on the other side of Bedminster Bridge (between Ashton Gate and the burst), there was a wash-out which took the whole flow of water from that main. The bridge was well within a mile of the burst; and the wash-out was for the relief of the low-level district in case of accident. The real protection, so far as the burst pipe was concerned, was the wash-out. Returning to the main question, Counsel said Mr. Fox had not apparently had any experience in the maintenance of water-works. He had simply constructed them, and had had some responsibility during the maintenance period. The evidence he had given concerning the stronger pipes near the Railway Company's line seemed to be an endeavour to try the question, not by any test of what was required in Redcliff Street, but by prejudice with regard to what took place somewhere else. He presumed that the action would be fought upon the question of what was reasonably required in Redcliff Street. With regard to the burst pipe, it was at first found fault with because it was of inferior material, inasmuch as it was not No. 2 cold-blast pig iron, but consisted of a less reliable mixture termed "Staffordshire and other brands." When this was complained of, Mr. Fox told him it was he who had inspired these particulars. They knew from the evidence that No. 2 cold-blast pig iron had not been the material from which water-pipes had been made for thirty years, to Mr. Fox's knowledge. He believed it had not been used for a longer period than this. A specification for such iron would be ridiculous, unless they had plant for cold-blast purposes. Then his learned friend relied upon what he called the "bursting" of the main. The main, as he had pointed out, had not burst, though certain pipes had. According to Mr. Fox's evidence, in spite of the standing and hydraulic tests and those made with the hammer, pipes having some undiscovered flaw had passed out of the foundry, and had got into the main, where they had burst. He proposed to call evidence to show that the pipes were properly made and properly tested.

William Hancock, a foreman in the employ of the Company, gave evidence as to being called when the burst occurred, and, with others, taking steps to check the flow of water. After shutting down the valve at Bristol Bridge, they opened the wash-out at Bedminster Bridge, and drove in a cab to Ashton Gate and turned off the stopcock. He afterwards went to Redcliff Street, where he found that the top part of the broken pipe had been forced off; the bottom portion being intact.

William Nelson, a watchman, *Frank Wyatt*, a turncock, and *John Ottery*, an assistant foreman, in the service of the Company, also gave evidence as to turning off the water.

Mr. *E. Brough Taylor*, of Messrs. Taylor, Son, and Santo Crimp, of Westminster, said he had been Consulting Engineer to the defendants since 1891; his late father, Mr. John Taylor, having previously held the position from 1887. His father designed the main from the Barrow filter-beds to the 27-inch main by Bristol Bridge. Witness was present at the Board meeting before the plans were got out for the main. When the question of the upper portion of the main was being discussed, two different routes were under consideration; and objection was taken to one of them because it crossed the railway, and some of the Directors thought there would be risk from the trains. However, it was held to be the superior route, and was eventually decided upon. His father was instructed to make the main strong enough to prevent any risk. Witness described the test to which the iron was submitted, and said it was subjected to the breaking test—the one then usually applied. This consisted in laying a bar 1 inch square between some boards 3 feet apart; in the centre of the bar was suspended 7½ cwt.; and the bar had not to break under this strain. All the pipes answered the test. It was usual now to have a bar four times stronger, and the weight four times as heavy; but, in principle, the tests were the same. He visited the works on several occasions, and observed the process of testing the pipes, which were examined on their arrival in Bristol. The main was completed in the early part of 1889, and was subjected to the test of closing the valve at the end of the 27-inch

main, and letting in the water from the top level of the Barrow filter-beds. The pressure in Redcliff Street was not the heaviest along the main. Asked to explain why the pipe had burst after withstanding pressures for sixteen years, witness said he took it that it had an initial defect which was quite undiscoverable at the time that the tests were applied. This microscopic defect might have existed, and gradually extended until the pipe became so weakened that the pressure blew the piece out of the main. If the pipe had been too weak at the time of its construction, the test applied would have burst it. The pressure he applied went up to 105 lbs. From time to time bursts of the kind in question took place; and it appeared to him, comparing this one with several others he had known, that the water was got rid of by the defendants in a very short time indeed.

Justice DARLING: You think they did the right thing?

Witness: Certainly, my Lord.

Cross-examined by Mr. FOOTE, witness said he saw the pig iron out of which the pipes were cast, and he thought there were two or three kinds. There was a double 24-inch main from Barrow to Ashton Gate, and there were 450 of the thicker pipes altogether. With the exception of 16, laid at Bedminster Bridge, they were all laid outside the city. With regard to latent cracks, he thought the development of a crack was independent of the thickness of the iron. In answer to his Lordship, witness added that some pipes lasted more than sixty years.

Mr. *J. Cochrane*, of the firm of Messrs. Cochrane and Co., Limited, pipe makers, of Dudley, gave evidence as to supplying the pipes for the main in question. He said that, according to contract, they were a good mixture of Staffordshire and other brands.

Mr. FOOTE: Are you prepared to say that the whole of the iron in these pipes was No. 2 hot or cold blast?

Witness: I am prepared to say it was hot-blast, and that No. 2 was suitable for the pipe.

And that it was composed not wholly of No. 2, either hot or cold blast, but of mixtures of different numbers?—It was composed of different numbers suitable for the size of the pipe, and had the material in it as described in the contract.

Mr. *J. A. M'Pherson*, the Chief Engineer to the defendants, stated that on the low-level system there were, roughly speaking, about 100 miles of big mains and about 200 miles of distributing mains. The pressure in the 24-inch main the week before it burst was from 55 lbs. to 70 lbs.; but at the time of the accident it was 83 lbs. This was well under the supposed strength of the main; and no notice would be taken of it.

Sir *Alexander Binnie* said he was acquainted with the water-works system at Bristol, and knew the gradient in which the pipe in question was laid. From his examination of the broken fragments, he was prepared to say that it was made of good sound metal. A ¾-inch pipe was the correct kind for this class of service. As far back as 1878, he laid a pipe 27 inches in diameter and ¾ inch thick at Bradford. It had a pressure of from 100 lbs. to 125 lbs., and was intact at the present time. Looking at the main in question as a matter of practical engineering, it was a proper pipe to lay in the particular place where it was. In fact, the experience of the past sixteen years was in itself a criterion that the main was very well designed. The occasional breaking of a pipe was common knowledge. For a reason that could not be explained, pipes sometimes broke, even after they had been subjected to every possible test. He had known bursts twenty years after the pipes had been at work. To the best of his judgment, the cause of the bursting of the pipe in question had been some concealed flaw that might be affected by rust or vibration. It was not the practice of engineers to place relief-valves on mains of this kind.

Cross-examined by Mr. FOOTE, witness stated that during the period before the engineer had taken over a main he had known as many as three bursts within a mile. He should regard this as a good thing—as an indication to get rid of the pipes.

Mr. FOOTE: It is said that, if these pipes had been 1 inch instead of ¾ inch thick, it would only have deferred the catastrophe?

Witness: They both would burst in time.

Would it not take longer for a crack to extend through 1 inch than through ¾ inch?—It may or it may not; it depends upon the strain.

With the same strain, would it not take longer to go a farther distance?—It may be longer or it may be shorter.

Can you give any mathematical reason why it would not take longer to extend through a thicker pipe?—I cannot.

Mr. *J. Watson*, the Water-Works Engineer to the Corporation of Bradford, said he had seen the pieces of iron forming part of the broken pipe, and he considered them excellent specimens. The material was close-grained cast iron, which betokened no irregularity in casting.

In cross-examination by Mr. FOOTE, witness said it was a prudent precaution to increase the thickness of the pipes which crossed a railway. He did not think people carrying on business were subjected to the same danger as railways. No doubt the reason why water-mains across railways rarely burst was the greater care taken in laying, and the extra thickness of the pipes.

Wednesday, July 18.

On the resumption of the hearing this morning, further evidence was given for the defendants.

Mr. *G. Strachan* stated that last June he visited Bristol and examined the broken pipe. He found it had been well made, and the fracture was a clean one. A thickness of ¾ inch was sufficient, according to engineering practice as he understood it. There was nothing to necessitate taking special precautions with regard to pressure; and there was nothing out of the way with respect to the main. The general arrangement of the system was most satisfactory; and it was well laid throughout. He did not think there should be any additional stopcocks on the large mains that conveyed the water in bulk. They were not needed so much as on distributing pipes. The ordinary practice in regard to stopcocks was to place them 2, 2½, or 3 miles apart. Relief-valves he considered dangerous things, which ought not to be put in unless absolutely necessary.

Cross-examined by Mr. FOOTE; Three bursts per mile in the first year of construction, he should regard as normal. There was no regularity about bursts; but this number might, during the maintenance term, be regarded as the proportion. He adhered to the statement as regarded the distance between stopcocks on a closed main.

Professor *Unwin* said he knew the surrounding circumstances of the pipe in question. A thickness of less than ¾ inch—say, 0·7 inch—would have been sufficient; but a 24-inch pipe could not be conveniently cast less than ¾ inch thick. This, therefore, was the proper thickness. He had examined the pieces of broken pipe, and had found that the iron was particularly uniform in thickness. It was not much corroded, and the fracture was a very good one. From the character of the fracture and the manner in which the upper part of the pipe was said to have separated, he formed the opinion that the burst was rather exceptional. The irregular line of fracture was generally progressive; but he could not judge positively as to its cause. A large number of bursts occurred of which the cause could not be decided. In his judgment, the previous bursts did not in any way condemn the main. There was nothing exceptional about them.

This closed the evidence for the defendants.

Mr. DUKE then addressed the Jury, saying that what they had to decide was whether the Water Company were negligent in adopting Mr. Taylor's and Mr. Cochrane's design of pipes in the construction of the main. These were the only matters it was possible to suggest to them among the many grounds of negligence which were alleged. Mr. Taylor was one of the most eminent water engineers of his time, and was a man of the widest experience. Every water engineer of any position who had the passing of a 24-inch main for the position of the one in question would have done what Mr. Taylor did. Dealing with the point concerning the thicker pipes near the railway line, Counsel reminded the Jury that with a burst on the railway there would have to be faced a disaster very different from the damage to goods in a warehouse. It might result in the washing away of a portion of the line, and very possibly be followed by a serious railway accident. What the Jury had to consider was the thickness for its purpose of the pipe in Redcliff Street, and not that of a pipe laid somewhere else. He laid stress upon the evidence of Professor Unwin, especially the statement that pipes 0·7 inch in thickness would have been sufficient. He also commented upon the fact that this witness was not cross-examined. Counsel contended that the evidence led to the conclusion that the true explanation of the burst was a latent or undiscovered minute crack in the pipe, which had expanded. The Company had not been negligent in accepting the design or the pipes; on the other hand, they had shown that the burst was incidental to the carrying on of a water-works undertaking.

Mr. FOOTE, in reply, agreed that the real issue was as to whether or not the burst was due to negligence. This, however, might be worded in a legal way, though the meaning might be the same—whether the burst was due to the absence of the diligence and care which it was the defendants' duty to exercise. He asserted that a high degree of diligence and care was expected from a Water Company like that of the defendants, who had statutory power to place in the streets of a great city enormous water-mains which were capable of doing a vast deal of damage unless the greatest care was exercised. He denied the allegation of his learned friend that the action was a speculative one. An accident occurred, and it was *primâ facie* evidence that something was wrong; and if they were going to sue the Company, they had to find out what it was. There were all sorts of probabilities in a case of this kind; and they had to protect themselves in the establishment of their claim. He submitted that what was a reasonable thing to do when the Company crossed the railway was a reasonable thing to do when they came along Redcliff Street. He was not there to say they were bound to lay the whole of the six miles with pipes 1 inch thick; as the precaution might not be so closely followed along country roads.

Justice DARLING, in summing up, reminded the Jury that a water company had a right and a duty to lay mains along the streets; but he pointed out that in doing so they were bound to construct their mains of pipes of proper material, and in such a way that they would satisfy reasonable people that the proper thing had been done. A company did not, of course, guarantee that no kind of accident would ever happen to the pipes; as accidents happened without any negligence at all. But what they were obliged to do was to take proper and reasonable care in constructing and managing their mains; and unless they did this, they were liable for damage incurred. Reviewing the facts of the case, his Lordship pointed out that on the six miles of main from Barrow to Bristol Bridge there had not been a burst since 1901 until the one in Redcliff Street which gave rise to the action. When the plaintiffs commenced the action, they had to prove negligence; and unless they could do this, there would have to be a verdict for the defendants. They first stated in the particulars "that the said pipe was of inferior material and insufficient strength, and was improperly, negligently, and unskilfully laid." They were asked to give further particulars; and they said: "The whole of the pipe was of inferior material, inasmuch as it was not No. 2 cold-blast pig iron, but consisted of a less reliable mixture, termed 'Staffordshire and other brands.'" Mr. Fox had told them that he was responsible for this. He (his Lordship) would like to point out to the Jury that the specification never said it should be No. 2 cold-blast pig iron. Mr. Fox had, in so many words, told them that there was no such thing as coal-blast pig iron—that practically it did not exist. According to the specification, the pipes had to be of good tough quality, not inferior to No. 2 cold-blast pig iron; and Mr. Cochrane's tender was for "our usual good Staffordshire mixture and other brands." A great deal of time had been occupied the previous day in putting to Mr. Cochrane questions which were undoubtedly inspired by Mr. Fox. The object of all this questioning was to get Mr. Cochrane to state that he made his iron of cinders. Some time was spent in the cross-examination of this witness, with the view of establishing an allegation of negligence—that the pipes were made of improper material. After devoting some time to this cross-examination, the allegation was withdrawn. If the Jury held that 1-inch pipe should be used instead of ¾-inch pipe, the obvious duty of the Water Company would be to open all the streets in Bristol where they had pipes of the latter thickness. What would be the cost, and what would be the state of Bristol, if this were done, he did not know. If the Jury said it was negligence on the part of the Company

to have put down the pipe in Redcliff Street, it would be negligence if they did not take up similar pipes in other places.

The Jury then retired. After ten minutes' absence, they returned and gave the following answers to questions put to them by the Judge :—

Are the defendants proved to be guilty of negligence in the construction, management, or maintenance of the main?—No.

If so, did the pipe burst in consequence of such negligence?—No.

If such negligence is proved, in what did it consist?—Nothing.

Judgment was accordingly given for the defendants, with costs.

Mr. FOOTE: They are not the questions I should have asked the Jury.

Justice DARLING: Nor are the answers those which you would have given. (Laughter.)

THE GAS EXPLOSION AT CAPE TOWN.

Town Council and Gas Company Liable.

In the "JOURNAL" for June 20, 1905, we reported the occurrence of a gas explosion at Cape Town, by which a large portion of Adderley Street was blown up, and serious personal injuries, some unhappily fatal, were inflicted. The matter was mentioned by the Chairman (Mr. J. E. Lilley) at the meeting of the Gas Company a few weeks ago. Legal proceedings were then pending against the Company and the Town Council in respect of it; and these have been fully reported in numbers of the "Cape Times" which have recently reached us. The action was brought by the Metropolitan Tramways Company against the joint defendants, to recover damages in three sums amounting to £3777, in consequence of their alleged negligence. The case came before the Hon. Sir John Buchanan, in the First Division of the Supreme Court, on the 6th of June; and the hearing occupied several days. Plaintiffs were represented by Sir H. Juta, K.C., Mr. Searle, K.C., and Mr. Struben; the Town Council, by Mr Schreiner, K.C., and Mr. M'Gregor; the Gas Company, by Mr. Benjamin and Mr. Russell.

The following were the main points in the plaintiffs' declaration: Prior to 1902, there existed a certain sewer, which was constructed by the Town Council, from the top of Adderley Street to the sea. The sewer was under the direct control and supervision of the Council; and it was their duty to take due and proper care that it was in a proper state of repair. The sewer had been used up to the year 1897 for the discharge of sewage; but about that time this user ceased, and the sewer was utilized by the Council for storm-water purposes. It was afterwards disused altogether, and blocked at certain points. About the year 1892, the Gas Company, with the knowledge, consent, and approval of the Council, laid across and underneath Adderley Street a high-pressure gas-main, which was subsequently used for the conveyance of coal gas and water gas from the Company's works at Woodstock to their works in Cape Town. The main was laid in such a manner as to intersect the crown of the sewer, and was at a certain point in direct communication with the interior. About the month of June, 1905, the sewer was in a condition dangerous to the public, arising from the acts, neglect, and default of the Council in blocking it up at certain points, in having no proper ventilation therein, and in consenting to the laying of the gas-main. The dangerous condition of the sewer also arose from the leaky condition of the Company's mains and pipes. It was the duty of the Company to keep their mains and other pipes in proper order, to prevent the escape of gas; and it was the duty of the Council to take steps to inspect the mains and pipes, and to ascertain whether they were in proper condition, and to insist on the Company putting and keeping them in order. Disregarding their duty, the Company, prior to June 13, 1905, allowed the mains or pipes to get into a leaky condition, either in or near Adderley Street, at or near the point where the high-pressure main intersected the sewer or at some other portion of their system of pipes; and in consequence of this neglect, gas was allowed to escape into the sewer. The Council, also disregarding their duty, neglected to keep the sewer free of gas and prevent gas from the Company's mains filling it, and further neglected to inspect the mains and pipes to ascertain whether they were in proper order, and to insist that they should be kept so. On or about June 13, 1905, the gas that had escaped into the sewer ignited, and an explosion occurred in Adderley Street; tram-lines of the plaintiffs being ripped up, broken, and destroyed, and their works in the said street injured for a considerable length. By reason of the damage, the street was closed to traffic for a considerable period; the line had to be relaid; and during this time the plaintiffs suffered loss through not earning the profits they otherwise would have earned, and incurred considerable cost in the management of their business and in legal expenses. They considered they were entitled to recover from defendants, jointly or one or other of them, the sums of £1044, £2033, and £700, being damages sustained by reason of their negligence.

The chief points in the Town Council's plea and claim were as follows: Prior to, and since, the year 1892, the Council had no knowledge of, and there was no reason to apprehend or contemplate, danger from the sewer to persons lawfully using the streets of Cape Town. Should the Court find that there was any duty on the Council such as is alleged by the plaintiffs, they say that they duly discharge it. The Council admit that the Gas Company had a main or pipe in the vicinity of Adderley Street, which was used for conveying gas; but they deny that the main was laid or used for the conveyance of gas with their knowledge, consent, or approval. They deny that the sewer was in a dangerous condition in June, 1905, but not that the main and pipes of the Gas Company were in a leaky condition, and that the gas escaped therefrom. They deny that they were under the duty to inspect the mains and pipes, and that they neglected to perform any duty in law resting upon them in this behalf. The Council admit that on June 13, 1905, there was an explosion in Adderley Street; that certain tram-lines belonging to the plaintiffs were damaged, and their works injured; and that the explosion was caused by the ignition of gas. But they submit that the gas was not ignited through any negligence on their part, and that they are not responsible for any escape of the gas which was ignited. The plaintiffs on that occasion, and immediately before the explosion, by their servants, fused a tram-rail joint; and for this purpose negligently applied an explosive mixture, without observing due precautions against danger arising from such an application in the neighbourhood of escaping gas, though the said plaintiffs had knowledge or notice that there had been, and was, such an escape from the pipes of the defendant Company at, or in close proximity to, the spot where the fusing took place. This negligence was the proximate cause of the explosion, and the plaintiffs by such negligence directly caused it, and any damage occasioned thereby, or contributed to cause it. Other allegations are denied; and the Council pray that the plaintiffs' claim may be dismissed with costs, and their own claim allowed for £712 3s. 9d. for loss sustained.

The Gas Company admitted certain of the plaintiffs' allegations; but they denied others. They said that even if their main did intersect the crown of the sewer, and was at a certain point in direct communication with the interior of it, it was not so by their act, or with their knowledge or consent. They said they exercised all due care and precaution in preventing escapes of gas, and in discovering and rectifying them; and if an escape occurred, it was not due to any act, neglect, or default for which they were liable, save in so far as was stated. They admitted that on or about June 13, 1905, an explosion occurred in Adderley Street, and that tram-lines and certain works were damaged. But they denied that it was due to gas which had escaped from their mains or pipes into the sewer, and said that even if it was due to such escaped gas, they were not legally liable. They said further that the explosion was due to the act, negligence, or default of the plaintiffs themselves, their agents, or servants, in persisting in using a certain process known as the "Thermit," and liable to cause an explosion, notwithstanding that they knew, and had received warning, that an escape of gas was supposed to exist in the neighbourhood at the time, and that it would be dangerous to continue to use the process. The Company concluded by saying that, even if plaintiffs had suffered the damages alleged, they were not entitled to recover all or any portion of their claim; and they prayed that the suit might be dismissed.

Sir H. Juta opened the plaintiffs' case in a speech of considerable length, in which he dealt with the principal points in dispute, as already set forth; and then evidence in support of his arguments was given. The first witness was Dr. A. J. Gregory, the Medical Officer of Health, who said the construction of the sewer was such that it was practically impossible to ventilate it. In a report made by him in 1896, he recommended that it should be filled in because it was dangerous to the public health. When he made the report, it was in his mind that the sewer should not be crossed by the Gas Company's mains. He was not prepared to swear that anybody informed him that the sewer was intersected by mains. Mr. Schreiner remarked that this statement was important, as the Town Council said they did not know that the main intersected the sewer. The next witness was Mr. T. W. Stanithorpe, the Assistant-Engineer of the Public Works Department, who said he could not discover that there was any ventilation of the sewer before the explosion. He attributed the leakage of gas to the service-pipes; as he first looked at the joints of the high-pressure main, and could find no escape. Across the triple sewers, at the junction of Strand Street and Adderley Street, there ran a high-pressure gas-main 9 inches in diameter, which cut through the crown of three sewers. There had originally been 9 inches of brickwork; but it had been cut through, and the main placed on the corner of the sewer. There was a smell of coal gas at that point on the morning following the explosion. He was shown where the "Thermit" joint was being made by the Tramway Company, and it was within 10 feet of the high-pressure gas-main. Shortly before the explosion, the Council built a head wall across the sewer; and he thought this was an important element in connection with the explosion. Asked by his Lordship to state specifically the cause of the explosion, witness said it was probably the accumulation of gas in the sewer, and most likely ignition took place at the moment the joint was being made by the Tramway Company's workpeople. He added that he regarded the sewer as an elongated underground gasholder; and he considered that it was dangerous to lay a gas-main across it in the way it had been done in this case.

In cross-examination by Mr. Schreiner, who asked Mr. Stanithorpe why danger arose from simply putting a pipe through the brickwork on the crown of the sewer, he said it was from the liability of the joint to spring. There were puffs of gas coming from the three sewers, the morning following the accident; and the only conclusion he could come to was that there was an escape from the joint over the middle arch. One of the Gas Company's workmen bared the joint in the presence of the members of the Commission on or about the 20th of June. There was no leak when they saw the joint. His candid opinion at the time he saw the pipes was that the joint had recently been tampered with. Further cross-examined by Mr. Benjamin, witness said his first impression was that the explosion was caused by the leakages from the branch pipes; but afterwards his attention was drawn to the lower part of the street. He should call the joint he had referred to an ordinary spigot and socket joint, not a turned and bored one. The reason he came to the conclusion that the joint had recently been tampered with was because at the point where the joint was made the lead was bright, and where the chisel had come into contact with the top of the cast-iron it was also fairly bright.

The next witness was Mr. E. G. C. Jones, an electrical engineer, who said he considered the explosion was caused by a leakage into the sewer of gas from the high-pressure main. He could not say whether its ignition was due to the making of the "Thermit" joint; but he did not think electrolysis had anything to do with it, or that the gas was sewer gas. Some evidence having been given by workmen in the service of the plaintiffs, Mr. W. Craig, the Chief Engineer of the Public Works Department, was called. He stated that he examined the middle joint of the high-pressure main, and, as it had a different appearance from the rest, he came to the conclusion that it had been recently set up. If there had been an escape of gas from that joint, it would have got into the sewers and so caused the explosion. Mr. C. F. Juritz, the Senior Government Analyst, said that, assuming the capacity of the sewer to be 30,000 cubic feet, in order to fill it with an explosive mixture, taking it at 11 per cent. of coal gas, it would require 3600 cubic feet of gas, He thought the explosion was caused by a mixture of coal gas and air being fired by a light. Mr. Alfred Giles, General Manager of the Tramway Company, stated that through

the explosion the tramway line was blown up in several places, and the repairs cost £1044. Apart from this, there had necessarily been a falling off in the receipts while the line was up.

This closed the evidence for the plaintiffs.

The case for the Town Council was then proceeded with; the first witness called being Mr. John Cook, the City Engineer. He said he had no idea until the 24th of June last year that a gas-main crossed the sewer. The record of the various gas-mains in Cape Town up to 1902 was very incomplete; but since then he had had plans of all the mains laid. After the explosion, he found that there was a water-main under the gas-main in Adderley Street. If the sewer had been filled up, there would have been no explosion. If he had known that a gas-main was running as it did, he would have said it was absolutely necessary to fill up the sewer and remove the main. He was not aware until recently that in several places in Cape Town gas-mains ran through the sewers. The Adderley Street sewer could not be ventilated except by forced draught.

The first witness called for the Gas Company was Mr. E. P. Reilly, their Engineer and Manager. He stated that, after the explosion, he immediately started opening the street to find out if the gas-mains had been damaged. He put in specimens of the ordinary lead joint and the turned-and-bored joint. He said he had never known of any leakage from joints in Cape Town. None of the gas-mains were disturbed by the explosion. He believed there was an aperture connecting the surface of the street with the sewer below the tram-rail joint which was being welded. The joint in the gas-main had not been recently reset. It was not possible to tell a joint which had lately been recaulked from an old one, by the appearance of the lead; but one could do so from the disturbance of the "barnacles" on the joint. Something like 30 per cent. of the damage to the gas-pipes was done by the Town Council. In cross-examination, Mr. Reilly stated that before the explosion he had nothing to show the depth of the high-pressure main in Adderley Street. He searched for leaks from the main after the explosion, but only found one. A report was made to the office on Monday, June 12, 1905, that there was an escape of gas. Next day, about 4.30 p.m., the main had been opened up, and the joint over the sewer exposed, and he thought he smelt some gas puffing out of the three sewers. He was now sure, however, that whatever was coming out of the sewer, it was not coal gas. A flame was burning near the tram-rail joint after the explosion.

Mr. Reilly was followed by Mr. W. A. Humphreys, the Assistant-Manager, who stated that on the evening of the day before the explosion he reported a leakage of gas in Adderley Street. About 2 feet away from where the "Thermit" joint was being made, he smelt gas, and ordered his foreman to open the spot next morning. The foreman was already working on the street. Next morning, the workmen filled up their excavation of the previous day, and proceeded to open the street near the high-pressure main. Witness saw the street opened after the explosion, and was almost constantly there up to 11.30 p.m. He saw the joint when it was exposed, and there was no gas coming from it. When the Commission of Inquiry into the accident examined the joint, everyone who came to look at it had a rub at it. Certain indications were pointed out by witness that could not exist if the joint had recently been reset. In February this year, on an examination of the main, it was discovered that a 9-inch gas-pipe was broken in two; and immediately underneath the broken main was a 9-inch earthenware drain-pipe running into the old triple sewer. The breakage of the pipes was evidently caused by some shrinkage of the ground.

Several witnesses who followed Mr. Humphreys expressed it as their opinion that the joint over the triple sewer had not been recently set up at the time of the explosion; and then the evidence (taken on commission) of Mr. W. Arnott, the Manager at the Cape of the South African Lighting Association, was read.

This brought the evidence to a close.

Subsequently Mr. Benjamin addressed the Court on behalf of the Gas Company; concluding his argument by submitting that there was no evidence of negligence on the part of his clients.

His Lordship remarked that the effect of Counsel's argument was that there was greater negligence on the part of the Municipality than upon the Gas Company. Mr. Benjamin submitted that there was. He contended that the leak did not take place from the Adderley Street sewer, but from a leak subsequently discovered. In case the Court was against him on the question of negligence, he submitted that if the Gas Company were negligent, the Town Council were also guilty. It was clear that both parties could be sued, and that both could be held liable.

Mr. Schreiner, addressing the Court in reply to Mr. Benjamin, said at the utmost it could not be alleged there was anything more than nonfeasance on the part of the Council in not filling the sewer.

Sir H. Juta, in reply, said that the greatest fallacy underlying Mr. Schreiner's argument was that the Council had no control over the Gas Company or their works. The Council were really in the position of an employer, and the Gas Company in the position of an employee; their relations were really those of principal and agent. The cases and illustrations given were inapplicable to the present instance, because there were no statutory powers under which the Company had come there. They had come there solely and entirely at the invitation of the Council, with their consent, and were doing work for them.

In delivering judgment, his Lordship said he had no doubt, after hearing the evidence, that the explosion was caused by coal gas; and the question to be settled was how the gas found its way into the sewer. The weight of evidence pointed to the fact that the principal source of the gas was the high-pressure main crossing the crown of the triple sewer. Consequently, he had to consider: Who was responsible for the escape? How did the gas get into the sewer? and, Was the subsequent explosion an uncontrollable accident or due to the negligence of either or both of the defendants? Dealing with the last point first, his Lordship said the principle laid down in *Fletcher v. Rylands* was that a person who brought on to his property materal which could be regarded as dangerous to others was answerable for damage done by its escape. "If," said his Lordship, "the principle laid down in *Fletcher v. Rylands* applies, the gas which caused the explosion was brought to the spot by the Gas Company. The Company had no statutory authority to bring the gas into the streets of Cape Town; but they cannot be said to have gone there unlawfully. The streets were under the control and management of the municipal authorities; and I think that it is impossible to hold that the Company brought the gas into Adderley Street without the knowledge, consent, and permission of the Town Council." His Lordship went on to deal with the position of the high-pressure main, and said the evidence adduced showed that the way of laying it was absolutely wrong. The Council had allowed this improper thing to go on, and it had resulted in damage. The defence set up by both defendants was that there had been contributory negligence on the part of the plaintiffs. He must say he could not accept this plea. The plaintiffs did what they were perfectly entitled to do. The only negligence alleged against them was the fact that there was a strong smell of gas at the place where the work of joining their rails was going on. But there was nothing to indicate that the smell came from any "concealed gasholder" under the earth. Summing up briefly, his Lordship said he thought it had been shown that there had been negligence both on the part of the Council and of the Gas Company; that there had been no negligence on the part of the Tramway Company; and consequently that they were entitled to damages for the loss they had sustained. He allowed the first claim (£1044). He reduced the second, which was for loss of profits, from £2033 to £250. He disallowed the third—a sum of £700 for the sinking of the rails. He accordingly gave judgment against the defendants jointly for £1044 and £250, with costs.

The Supply of Water to the Hull Dock.

In the "JOURNAL" for Dec. 12 last year (p. 761), we reported the proceedings in an action brought by the Attorney-General and the Corporation of Kingston-upon-Hull (as relators) for a declaration that it was *ultra vires* for the North-Eastern Railway Company to supply the dock at Kingston-upon-Hull with water obtained from land at Hessle, forming part of their undertaking, for any purpose connected with the dock, or to sell or supply water so obtained to any tenant of the defendants occupying premises within the dock, or to any ship using the dock, or otherwise to carry on the business of a water company. The Company contended that they were entitled to use their land for any purpose not inconsistent with that for which it was acquired, and that the supplying of water was incidental to the carrying on of a dock. The action was tried by Mr. Justice Joyce, who held that there was nothing illegal or *ultra vires* in what the Company were doing; and he dismissed the action. His decision was appealed against; and the case was argued before Lords Justices Vaughan Williams, Romer, and Fletcher Moulton a few days ago. Mr. Danckwerts, K.C., and Mr. R. J. Parker appeared for the appellants; Sir R. B. Finlay, K.C., Mr. Hughes, K.C., and Mr. W. Gutch represented the respondents. At the close of the arguments, Lord Justice Vaughan Williams delivered judgment, in which he expressed the opinion that the use of the water from the well on the land of the Company at the Hessle Station, for the purpose not only of railway objects, but also for things which were necessary to be done for the efficient carrying on of the dock, was in no sense *ultra vires*, and was nothing more than the Company were entitled to do. He came to the conclusion that the appeal ought to be dismissed. Lords Justices Romer and Fletcher Moulton delivered judgment to the same effect. The appeal was accordingly dismissed.

Hampton Court Gas Company's Assessment.

The Kingston-upon-Thames Assessment Commitee recently had before them an appeal by the Hampton Court Gas Company against an assessment of £700 gross and £595 net in respect of their mains in East Molesey. Mr. W. G. Lamb, the Secretary of the Company, stated that in 1902 the Company's net assessment was fixed by the Committee's valuer at £421; and though the Company thought it was excessive, they agreed to it. They could not understand, however, why it had since been increased to £595, which was equal to a rise of 41 per cent. He admitted that there had been a new main laid in one road, and a 10-inch main substituted for an 8-inch one in another. The additional cost was about £200, after allowing for the old main being taken up; but this did not justify the increase that had been made. Except in a few special circumstances, the cost of laying on services to houses was paid for by the consumers. Replying to questions by the Clerk, Mr. W. E. Price, the Company's Engineer, said that the life of a gas-main varied according to the soil in which it was laid. In one part of Molesey it would be from thirty to forty years, and in another part from twenty to thirty years. A gravel soil gave the longest life to a main. Mr Condell, the Assistant-Overseer, pointed out that the Overseers had in mind the fact that within the last three or four years there had been from 200 to 250 new connections; and after considering the matter with a person well versed in such things, they felt that this increase would not be an unfair one, and that in the event of an appeal the Company would be able to give them some figures as a guide. Personally, he was unable to speak with any technical knowledge on such a subject, and thought that a professional valuation would be more satisfactory. The Committee decided that an increase of the old net assessment from £421 to £442, to cover the additional outlay on the two mains, would meet the case; and they reduced the assessment to this figure.

Gas-Lighting for Baths.—Three schemes were received by the Baths Committee of the Lewisham Borough Council for improving the gas-lighting of the first-class swimming-baths which are to be adapted for a public hall during the winter season. The Keith system is to be fitted up; the installation consisting of a No. 3 compressor and six 600-candle power "arc" lamps—at a total cost of about £60. The Baths Committee of the Islington Borough Council reported last Wednesday that the incandescent system of gas lighting had been installed throughout the Essex Road baths at a cost of £100. A great improvement had been made in the lighting, and a considerable saving in the cost of gas had been effected.

MISCELLANEOUS NEWS.

EUROPEAN GAS COMPANY, LIMITED.

The Annual General Meeting of this Company was held last Tuesday, at the London Offices, Finsbury House, Blomfield Street, E.C.—Mr. R. HESKETH JONES, J.P., in the chair.

The SECRETARY (Mr. W. Williams) read the notice convening the meeting, and the following report of the Directors:—

The Directors are again able to report an improvement in the Company's business during the past financial year; the sale of gas showing an increase in the aggregate of 1¼ per cent. This increase is largely in gas used for cooking and motive power; and the Directors continue to offer every inducement they consider prudent, in order to encourage the use of gas for all suitable purposes.

Coals have cost somewhat less than during the preceding year, and coke gives an improved return; but the revenue from both tar and sulphate shows a slight decline.

The year has not been without anxiety as regards labour; but every endeavour is made to promote provident habits among the men, and to attach them to the Company by the ties of gratitude and self-interest.

As far as they are able to judge, the Directors believe that their efforts, ably seconded by the Managers acting in the same spirit, have had satisfactory results, and that a good feeling prevails amongst the Company's staff of workmen and employees.

The profits for the year enable the Board to recommend the payment of the usual dividend of 20s. per share on the fully-paid shares, and 15s. per share on those £7 10s. paid, less the interim dividend of 8s. and 6s. per share respectively paid on the 1st of February last; also that a bonus of 1 per cent. be paid on all shares according to the amount paid thereon, subject, however, to a deduction for French stamp and transfer duty of 1s. 1d. per fully-paid share, and 10d. per share £7 10s. paid in respect of all shares held in France.

Notice has been given that two Directors (N. E. B. Garey, Esq., and H. C. Smith, Esq.) and both Auditors (J. Reeson, Esq., and A. T. Eastman, Esq.) retire from office at this meeting; but, all being eligible, they offer themselves for re-election.

The CHAIRMAN said, in proposing the adoption of the very satisfactory report which had been read by the General Manager, he would not weary the shareholders with many dry statistics; but it might interest them if he referred to a few items in connection with the Company's affairs during the past year. Some companies increased their business by leaps and bounds—not always to the advantage of their shareholders. Their own Company were not of that class. But, notwithstanding, the gas-rentals had increased by £2279; and they had connected 3013 additional consumers. Coals had cost the Company about 2½d. per ton less than in the prior year, with a slight improvement in the value of coke; but tar and sulphate of ammonia brought in £600 less. The Directors did not wish to credit themselves with special foresight; but some months since they secured a supply of coal up to October of next year at the then reduced prices. The profits at the stations, after making full provision for amortization, did not show a very large increase, owing to commercial depression in the towns of Havre and Rouen. On the other hand, there had been an increase in the interest received on investments. While alluding to Havre and Rouen, it must not for one moment be thought that the able Managers in these towns had relaxed their exertions. On the contrary, one might say that, having to face bad times, they had, much to the satisfaction of the Board, produced excellent results under circumstances over which they had not the slightest control. To all the Company's Managers much credit was due. The sale of gas per ton of coals carbonized exceeded 10,000 cubic feet; thus showing good production, and small leakage. The most progressive of all the towns supplied by the Company was Nantes; and, owing to the somewhat limited area of the works, it had become necessary to consider the provision for further extension. His distinguished colleague, Mr. Harry Jones, with the General Manager, accompanied him (the Chairman) last month on their annual visit to the stations. They stayed at Nantes four days, and went very carefully into this question. They inspected some riverside property; and, after very close consideration, came to the conclusion that, by re-modelling the existing works during the next four or five years, with the possible introduction of vertical retorts as an additional aid in the production of gas, they might be made capable of meeting the requirements of Nantes for many years to come. With regard to the abolition of the coal-tax next November, were it not that they had provided themselves with a supply of coal till October, 1907, the Company would not derive much financial benefit therefrom, owing to the rise in the price of English coal this summer. The Company's concessions (this was interesting) averaged 29 years—*i.e.*, Nantes 40, Caen 35, Boulogne 34, Amiens 30, Havre 24, Bolbec 20, and Rouen 17. One might say the stability and prosperity of the Company were well assured; and with great pleasure he moved the adoption of the report and accounts.

Mr. N. E. B. GAREY seconded the motion, which was unanimously carried.

On the motion of the CHAIRMAN, seconded by Mr. E. F. WHITE, the dividends and bonus recommended in the report were declared—the Chairman remarking that, put briefly, what they amounted to was 10 per cent. dividend, and 1 per cent. bonus.

Proposed by the CHAIRMAN, and seconded by Mr. ARTHUR SKAIFE, the retiring Directors, Mr. N. E. B. Garey and Mr. H. C. Smith were unanimously re-elected.

On the motion of Mr. SKAIFE, seconded by Mr. COLLINS, Mr. J. Reeson was re-elected an Auditor; and his colleague (Mr. A. T. Eastman) was also re-appointed, on the motion of Mr. COLLINS, seconded by Mr. COSSEY.

The CHAIRMAN, in proposing a vote of thanks to the officers and staff, said their Secretary and General Manager (Mr. Williams) continued one of the most zealous officers of a Gas Company he had ever met. His long experience in connection with the Company was of extreme value to the shareholders. As to their friends on the other side of the water, he had already said that Mr. H. E. Jones and Mr. Williams had accompanied him on a tour of inspection; and they could not but express their great gratification at the way in which their chief resident officers undertook their duties and acted as the agents of the Company. They were most tactful in their dealings with the Municipalities and other authorities. They were also very discreet in connection with the staff; and, on the whole, they were a set of men of which one was extremely proud. As he said before, he said again—they were a very "happy family."

Mr. H. E. JONES, in seconding, remarked that, as the Chairman had informed the shareholders, he had had the advantage of inspecting the Company's works during the last year or two, and of meeting the gentlemen of their staff. It would therefore be unfair if he did not promptly rise to say "Ditto" to all the Chairman had said on their behalf; and he would like to add that the under officials in London also deserved their meed of praise. With regard to the technical officers abroad, he had been very much struck, and every year more so, by their great qualities. They were good engineers, most of them were men with diplomas, modest, and very loyal to the Directors. The very smallest outlay they contemplated or wanted, they faithfully submitted to the chief office; and their demands, with a progressive Chairman such as they had, were generally acquiesced in. Their economies and the care they took over small matters, constituted a principle which, if extended to English gas-works, would, he could tell the shareholders, result in a good deal more profit on this side. It was always a pleasure and a great advantage to go and see the technical officers and the works, and especially in the company of their active Chairman and the General Manager.

The resolution was unanimously carried.

Mr. WILLIAMS said he was sure the staff would be very gratified to hear how highly their efforts were appreciated. He also thanked the Chairman and Mr. H. E. Jones for the very kind remarks they had made concerning himself.

Mr. A. T. EASTMAN moved a vote of thanks to the Chairman and Directors for their most successful conduct of the Company's business during the past year. They must compliment the Board upon the results—upon the increased sale of gas, and more particularly upon the increased day consumption. This was a very important feature; and it showed the continued efforts in this direction, which had been quite a feature of the Board's policy.

Mr. J. REESON seconded the motion, which was agreed to.

The CHAIRMAN responded on behalf of himself and colleagues—observing that it was the greatest pleasure to him to be able to occupy the chair at his time of life, to be blessed with that activity of which Mr. Jones spoke, and to retain the confidence of the shareholders. So long as he had health, he would devote it to the interests of the Company.

COATBRIDGE PUBLIC LIGHTING.

Electricity Superseded by Incandescent Gas.

At the last Monthly Meeting of the Coatbridge Town Council, a minute presented by the Fire and Lighting Committee set forth that the Clerk had written to the Gas Company for the terms on which they would be prepared to renew their contract for the lighting of the public street-lamps for the ensuing season, from the 15th of August to the 15th of May, 1907, and also for the terms on which they would carry out the substitution of incandescent gas-lamps for electric lamps, and that he had submitted the following letter, dated the 6th inst., which he had received from the Secretary (Mr. W. Johnston) in reply:

Dear Sir,—Referring to your inquiry of the 18th ult., the question of street lighting has now been fully considered by my Directors, both as regards your Council's requirements in the matter of the time of lighting and the substitution of incandescent gas for electricity, and on the footing mentioned in your letter, I am instructed to offer to supply gas, light, extinguish, paint, maintain in a thorough state of repair, and provide all necessary renewals of mantles and other requisites for the street-lamps for the ensuing season, from the 15th of August, 1906, till the 15th of May, 1907, at the same rates as last year—viz., 64 300-candle all-night self-intensifying lamps, £4 19s. each; 64 300-candle half-night self-intensifying lamps, £2 15s. each; 100-candle all-night No. 4 Kern, £3 5s. each; 100-candle half-night No. 4 Kern, £2 0s. 6d. each; 18-candle all-night No. 4 flat-flame Bray's burner, £2 9s. each; and 18-candle half-night No. 4 flat-flame Bray's burner, £1 7s. each.

A new time-table, showing the hours when lighting is completed and extinguishing commenced, has been compiled from Ingles' official vehicular lighting table [copy enclosed]; and we hope this will meet with your Council's approval. If any alteration in the price of gas takes place, there will be a proportionate increase or decrease in the rates as before, and payment is to be made in equal portions at Dec. 15 and May 15.

Regarding the substitution of incandescent gas for electric lamps, my Directors could supply high candle-power lamps, if desired, to replace the electric arc lamps at the following rates per season: 600-candle power self-intensifying all-night lamps, £8 15s. 6d. each; 600-candle power self-intensifying half-night lamps, £4 6s. 9d. each. Two of these would yield 200 candles more than an arc lamp at its maximum efficiency; and if placed at opposite sides of a busy street junction or crossing, on a special pillar, would be very effective. A Lucas lamp of 1000 candles could also be provided for use on arc pillars, as in Alloa and Hamilton; but the first-mentioned method gives a better diffusion of light, and is more easily kept in order.

In replacing the Nernst electric lamps, the present small-pattern lantern does not permit of a No. 4 Kern burner being fitted; but these can be stored to meet your additional requirements in new streets, &c. There are 20 large-pattern lanterns which could be utilized with No. 4 Kerns at small cost; and as an alternative, we could offer Podmore and Thomas's recuperative lamps, which yield double the candle power of the No. 4 Kern burner, at the same annual charge—viz., all-night, £3 5s. each; half-night, £2 0s. 6d. each.

For the guidance of your Committee, I append, as requested, a statement of the cost of the various systems, from which they can make choice, so that the necessary arrangements may be made.

Statement of Cost of Substituting Incandescent Gas-Lamps for Electric Lamps.

FOR ARC LAMPS.

(1) Special 600-candle power self-intensifying Welsbach, in strong hexagon copper lantern, including burner, frog, and 11 ft. 3 in. cast-iron pillar to match present pillars, with pipes, fittings, and labour connecting, £10 19s. 2d.

each. If in tinned steel lantern, the cost will be £1 less. (2) 300-candle power self-intensifying Welsbach, in copper lantern, including burner, frog, and 11 ft. 3 in. cast-iron pillar as above, with pipes, fittings, and labour connecting, £5 1s. 2d. each. If ordinary 9 ft. 3 in. pillar is used, cost will be 17s. 3d. less. If present pillars are utilized, the total cost will be £3 os. 8d. each. If special cylindrical shadowless lantern is used, there will be an extra cost of £2 if in copper, and £1 5s. 6d. if in tinned steel.

FOR NERNST LAMPS.

(1) 100-candle power No. 4 Kern burner, in Sugg's patent 16 feet Windsor tinned steel storm-proof lantern, with ball trap-door, including frog, with pipes, fittings, and labour connecting, £2 os. 5d. each (present pillars to be utilized). If new large copper lanterns of present pattern are required, the cost will be 2s. each extra. If 20 large rebuilt copper lanterns (in stock) are used, the cost will be 9s. 6d. each less. (2) 200-candle power Podmore and Thomas's patent copper and tinned steel storm-proof lantern (can be got wholly copper at an extra cost), including burner, governor, frog, pipes, fittings, and labour connecting, £2 14s. 2d. each (present pillars to be utilized). *Note.*—As mentioned in offer, this lamp, which gives double the illuminating power of a No. 4 Kern, is quoted at same rate per season.

It was agreed to accept the Company's offer for the lighting of the lamps for the season, and to approve of the lighting time-table proposed by the Company. With reference to their statement of the cost of substituting incandescent gas-lamps for electric lamps, the Committee resolved to recommend that the second alternative offer for the substitution for arc lamps of 300-candle self-intensifying Welsbachs, in copper lanterns, at the sum of £5 1s. 2d. each, and the first alternative for the substitution for Nernst lamps by 100-candle No. 4 Kern burners with copper lanterns, at the sum of £2 2s. 5d. each, should be accepted. It was also agreed to make it a further condition of the acceptance of the offer to light the lamps that, so far as necessary, the Company should take down and store all the lanterns during the interval between lighting seasons. As a consequence of this acceptance of the Gas Company's offer, the Committee instructed the Clerk to intimate to the Electric Light Company that the Council will not renew the previous contract with them, and to ask them to remove forthwith the arc and Nernst lamps which they had erected, and wiring and fittings connected therewith, in so far as not already done.

Bailie LAVELL, in moving the adoption of the Committee's recommendations, pointed out that they purposed lighting the streets this year entirely by gas. It simply meant that the 12 arc lamps would be replaced by 31 self-intensifying lamps at a cost of £5 1s. 2d. each, and the places of the 66 electric lamps would be taken up by No. 4 Kern burners of 100-candle power. The cost in connection with this substitution would be something extra. It would mean a capital expenditure in lamps, &c., of £220, a loan for which, spread over thirty years, would entail an annual outlay of £22. He thought the proposed new light would be as serviceable and as good as the present. The time-table had been altered considerably, and was now in accordance with the official one, and would work out more satisfactorily.

The PROVOST (Mr. M'Cosh): You will have more gas for the same money.

Bailie LAVELL said they would have about a hundred lamps more light. Of course, it meant £300 more to the Gas Company. They might have had some of the larger lamps at £8 15s. 6d.; but they had had no experience of these. He suggested that it might not be out of place if the Gas Company erected one or two of these during the lighting season, which he believed they might have permission to do. He hoped this arrangement would prove more satisfactory than that of last season.

Mr. LAMBERTON asked the Convener, with reference to the figures he had submitted, if there was any guarantee from the Gas Company that the rates they proposed to apply to the lighting of the burgh would not rise along with the price of gas to ordinary consumers.

Bailie LAVELL said the contract was only for one year. There was the possibility that next year they might increase the cost; but it was remote. He thought the following provision in their offer covered the matter: "If any alteration in the price of gas takes place, there will be a proportionate increase or decrease in the rates as before."

The PROVOST: Of course, if you bind them to more than one year, you will require to be bound too.

The TOWN CLERK said the Company were prepared to go into a contract for five years; but the Committee did not think it desirable.

Mr. BALLANTYNE said he was not there representing the Gas Company; but, as the Town Clerk said, they had proposed to make a contract for five years. Now that their profits were dependent upon the sliding-scale, they had no inducement to raise the price of gas to the consumers.

Mr. ORR pointed out that the Company were bound to supply the Council with gas at the same figure as other consumers. The only way they could raise the contract price to the Council would be in the charge for lighting and cleaning the lamps. But the Council had the alternative of contracting this out to others.

After some further remarks,

Mr. LAMBERTON said he was satisfied with the outcome of the discussion. He thought it could not be gainsaid that the fact that they had an Electric Light Company had been a very important point in bringing about the cheap lighting of their streets by gas.

The PROVOST: And the better lighting, you may say.

Mr. LAMBERTON said that now they were going to break with this competitive Company, it was desirable they should have an understanding with the Gas Company that they would deal with them in an honourable way in regard to future charges; and he thought that what was proposed in this year's lighting scheme might be made the basis for future years.

The TOWN CLERK remarked that, as Mr. Orr had suggested, the Company were bound to give the Council the same terms as to their other consumers; and he thought they were quite safe with this.

The minute was then adopted, and the new scheme, dispensing with electric lighting and substituting incandescent gas, was ratified.

A further loan of £2200 for gas-works extension purposes, and £800 for the water-works has been agreed to by the Hunstanton Urban District Council.

THE FATALITY AT THE COVENTRY GAS-WORKS.

Opening of the Inquest.

The inquest into the circumstances attending the death of Edward Howarth, who met with serious injuries in the recent explosion and fire at the Coventry Corporation Gas-Works on Sunday, the 8th inst. (see *ante*, p. 196), was opened on Monday last week, before the Coroner (Dr. C. W. Iliffe); Mr. R. E. Graves, H.M. Inspector of Factories in charge of the Birmingham district, being present. The inquest was attended by Mr. W. H. Batchelor (the Chairman of the Gas Committee), Mr. F. S. Jackson (the Vice-Chairman), and other members. The Town Clerk (Mr. G. Sutton) was in attendance to represent the Corporation.

Mrs. *Howarth*, the widow, stated that her husband was carbonizing foreman, and worked in the retort-house. After the accident she went to see him at the hospital, and when she asked him the cause of the accident, he said: "That lamp."

George Taylor, retort-house foreman, deposed that the accident took place near the centre of the purifying-house. Witness had noticed something amiss, and he and another man went to see what it was. About a quarter to nine witness informed Mr. Winstanley, the Works Manager, that there must be something radically wrong in the works. He was told to get a lamp, and he did so. Mr. Winstanley said there was nothing wrong, and added that if they did not find anything they were to send for him, as he was going away for an hour. He, however, came back just about ten o'clock. Deceased asked witness to give him a lamp. Witness saw him lift it up over the boxes, and then there was a flash. Witness thought the gas was ignited by the lamp, which must have been due to the lamp being faulty, or else it was unsuitable for the job. Witness knew there was an electric lamp on the premises, and had used it before. The reason why one was not taken this time was because they were not in the works. If electric lamps had been used, he did not think the accident could have occurred. Witness had not had instructions given to him that lamps similar to the one taken were only to be used when it was quite safe. He took the first lamp he could find, because he did not know where the electric lamp was. Mr. Winstanley did not ask him to get any particular lamp. It was the "back end of winter" when he last saw the electric lamp used.

In answer to Mr. Graves, witness said he tried several taps in the purifying-house, and found there was no pressure. This indicated to him that they were near where the irregularity was.

Frederick Charles Cole, the boiler and engine man, spoke to seeing the meter working backwards; and said he and the last witness tried to find out what was the matter. While witness was in the boiler-house, he heard an explosion in the vicinity of the purifying-house. He went out and saw the flames. He also saw Howarth, a portion of whose clothing was in flames, and other parts were smouldering. Witness, with the assistance of others, put out the fire, and deceased was sent to the hospital.

Alexander Stewart, general yard foreman, described the usual operations going on in the purifying-house. He said that on Saturday (the day before the accident), the purifier-box was filled with fresh oxide, and everything seemed to be all right. He asked the man in charge, named Alldridge, if this was so, and he said "Yes." On the Monday following the accident, he was told that the cement which should have been employed for making the lid gas-tight did not appear to have been used. He thought, however, that this had been done by Alldridge in the absence of a workman named Johnson, who usually did work of this class.

James Johnson, general fitter, said it was his duty, whenever a lid on the bottom of one of the purifier boxes had to be shut and jointed, to do it; but prior to doing so he had instructions. On the Friday before the accident, he was asked to make some cement for the purpose of jointing up one of the boxes. He made it; and as he was going with the workmen's excursion on the Saturday, he told someone where he would leave it—on one of the benches. He was not told who was going to make up the joint. Having made the cement, witness put it on the bench where he said it would be. The following Monday morning, he found the cement was where he had left it, and he used it for jointing the lid of a box. In his absence, he took it that Alldridge would do his work.

William Goode, a ganger, said that since last August he had had charge of the men who fill the purifiers. It had always been his custom to see that the lid of the shoot was properly closed, and to fetch Johnson to make the joint tight. He did so on the Friday before the explosion. Witness looked upon Alldridge as being in charge of the box in the absence of himself and Johnson. Alldridge had only once before made the joint of a box.

Arthur Alldridge, ganger over the men emptying and filling the purifiers, stated that on the Friday he started to empty No. 5 purifier, and on the next day filled it. Stewart then came to him and asked him if all was ready for turning on. He understood by this the putting on of the top lid. He had only once sealed the lid, this usually being Johnson's work. He had no instructions to seal up the lid, and he should not consider it his duty to do so. He did not ask that some Scotch cement should be made up to seal the lid. He did not know that Johnson was going to be away on the Saturday.

By the CORONER: He did not regard it as part of his duty to see that the lid was all right.

By the TOWN CLERK: He assisted to turn on the valves, and at that time did not know but that the box was properly sealed. He had only sealed the box once before, and then upon instructions.

The CORONER: I do not think he is in the slightest degree to blame.

Some conversation followed, in the course of which the Engineer and Manager (Mr. Fletcher W. Stevenson), replying to the Coroner, said the old type of safety-lamp would in future be broken up.

The CORONER intimated that it would be necessary to have the evidence of Mr. Winstanley, who was injured by the explosion, in regard to the instructions given.

The inquest was then adjourned until the 30th inst.

GAS-METER TESTING IN EDINBURGH.

In his first annual report upon the working of the Edinburgh Gas-Meter Testing Department, for the year ending May 15, Mr. William Gordon, the Official Inspector, states that the number of meters tested amounted to 98,363—17,614 wet, and 80,749 dry. Fees to the sum of £2675 were collected. The total number of meters tested by the department since its institution in 1861 is 2,079,615; the fees received being £61,682. The large number of dry meters tested and stamped during the past year is due, says Mr. Gordon, to the general recognition of their exactness as measuring instruments. The prepayment meter continues to be a very popular medium for supplying consumers with gas; and he has made arrangements for the exact number of automatic meters tested and stamped by the department to be carefully recorded for future reference.

Of the 80,749 dry meters tested last year, 681 were incorrect, or 0·84 per cent.; while of the 17,614 wet meters, 35, or 0·19 per cent., were incorrect. The average fee per meter tested was 6·53d. The fee for testing a one to five light meter is 6d.; the charge increasing from this minimum according to size.

A SUCCESSFUL YEAR AT BURSLEM.

At their last Monthly Meeting, the members of the Burslem Town Council had placed before them a statement regarding the operations of the Gas Department during the past year.

Mr. S. Johnson, the Chairman of the Gas Committee, said that, considering all things, they had had a very successful twelve months. The gross profit was £10,511, as compared with £10,509 for the previous year. This increase was, of course, very slight; but when the low price at which residuals were sold was taken into account, it would be seen that the Committee had been fortunate to hold their own. The receipts from residuals were £7344, as against £7742. The net profit for the year, after paying interest and instalments of loan and contribution to sinking fund, was £2250, as against £3536, or a decrease of £1286. This decrease appeared to be rather a serious item; but it was accounted for mainly by the final payment to the sinking fund of £1552, which had to be made in order to cover the loss on Consols which were purchased for the repayment of the first instalment of the Admiralty loan. There had also been an extra expenditure of £85 incurred in offering opposition to the Wolstanton Gas Bill. These two items alone made up a total of £1637, which, under ordinary circumstances, would have been added to the net profit. Then, again, during the year they had improved the street lighting by converting lamps in several of the main streets from the old flat-flame to incandescent burners. This had cost the Committee about £100, which they had given as a present to the Highways Committee. If these three items were added to the net profit it would total to £3987; and so in ordinary circumstances the profit would have been £451 greater than in the previous year, instead of £1286 less. Taking into consideration the amount of property lying vacant in the borough, and the fact that the undertaking had had to withstand the competition of the municipal electricity works, which no doubt had robbed the Gas Department of some good customers, he thought he could claim a fairly successful year. He was very proud of the present financial position of the undertaking. The balance due to the Treasurer on March 31 was £31; so that the overdraft had almost disappeared. When he was first appointed as Chairman of the Committee, this balance stood at £7108; and he had all along been determined to alter such a state of things. While the Committee had kept up the general efficiency of the works (which he believed were never more up-to-date than now), they had also had a keen eye on ways and means. They had retained their profits during the last two years—a matter which had not been altogether easy. He had been criticized for holding on to a policy of trying to get out of debt before giving away their profits; but that policy, he ventured to think, had been the best for all concerned. They had now the satisfaction of knowing that the undertaking was on a thoroughly sound basis. At the end of June of the present year, there was a credit balance of £4737 in the revenue account. This was a good working balance, the securing of which he had always advocated. He hoped that for the future the Council would insist upon having a really good balance to work with, before giving away their profits. A sum of £1200 had already been voted out of this year's profit for the relief of the rates, provided the balance-sheet proved satisfactory; and he was glad to be able to say that the Committee could pay this amount without doing what had many times been done in the past—borrow from the bank. He had hoped to be in a position to lay before the Council some proposals for the reduction of the price of gas to at least two classes of consumers—the users of slot meters and those who consumed gas for power purposes. Owing, however, to pressure of other business, the Committee had not, at their last meeting, been able to deal with the matter. He hoped the subject might be laid before the next meeting of the Council. The total output of gas during the past year was 230,186,000 feet, as against 225,602,000 feet in the preceding year, or an increase of 2 per cent. The coal used during the year amounted to 20,315 tons, as against 20,613 tons, or a decrease of about 1½ per cent. The gas made per ton of coal was 11,317 cubic feet, as against 10,964 feet. In 1904, the make per ton was only 10.163 feet; so that good progress had been made in this direction. The improvement was due to the better quality coal that had been carbonized. He was hoping the results during next year would be still better. He noticed that one neighbouring undertaking at least had achieved better results than Burslem, having produced 12,000 cubic feet per ton of coal used. If it was possible to do this at one works, he thought it could be done at Longport; and he should not be satisfied until as good, if not better, results were obtained. The loss through leakages during the past year was 11 per cent., as against 9 per cent. This was a very serious item, and one that with care ought to be very greatly reduced. The question of leakages was one which was receiving the greatest consideration from the Gas Manager; and Mr. Johnson said he was anticipating that he would have a very much improved statement to make next year. Important changes had taken place at the works during the year, which he trusted would be to the welfare of the concern. In Mr. Edward Jones they had a good and efficient Manager; and though he had not been with them long, he (Mr. Johnson) was perfectly satisfied with the change that had been made, and believed that with the application of energy and resource they would obtain more out of the undertaking than hitherto.

PUBLIC LIGHTING OF TUNSTALL.

After considering tenders from the Burslem Corporation for electricity and from the British Gaslight Company for gas, the Tunstall Urban District Council have accepted the Company's offer for gas for one year—subject to the Company agreeing to an adjustment of the charge for lamps which may not be lighted during the whole of the year. The Burslem Corporation are to be invited to tender for a modified scheme of electric lighting on lines to be hereafter decided by the Highways and Buildings Committee.

The British Gaslight Company's tender was for a further period of one or three years from the 1st prox., at the following rates: Ordinary 5 cubic feet batswing burner lamps, £2 13s. 4d. per annum; lamps having three 4 feet batswing burners, to be reduced to one burner at 11 p.m., £4. Incandescent, 4 cubic feet per hour per night, £2 14s. 4d.; do. extinguished at 11 p.m., £1 16s. 8d.; do. double-burner lamps all night, £4 15s. 10d.; do. double-burner lamps extinguished at 11 p.m., £2 16s.; do. three-burner lamps, two extinguished at 11 p.m., and the other all night, £4 17s. 4d.; 100-candle power lanterns by meter on average consumption, 2s. per 1000 cubic feet; extra charge (meter lamps only) for lighting and cleaning, 13s. per lamp per annum; do. reducing lights at 11 p.m., 4s. 4d.

The Burslem Corporation offered, subject to a formal contract for a period of not less than three years, to supply sixteen electric arc lamps, to be placed in approved positions. These lamps to be lighted from one hour after sunset to 11 p.m.; and when they were turned off, two incandescent lamps, attached to each lamp-pillar, to be switched on and kept alight until one hour before sunrise. The charge for the lights to be £240 per annum (£15 per lamp), which would include the use of the pillars and lamps and necessary fittings, which would remain the property of the Burslem Corporation, and all cleaning, trimming, maintenance, and current.

STAFFORD GAS AND ELECTRICITY SUPPLY.

The Accounts for the Past Year.

In their report for the year to March 31, the Stafford Gas and Electricity Committee state that "business shows a steady increase in both the departments."

The output of gas for the year was 191,652,000 cubic feet; and the quantity accounted for, 187,813,139 cubic feet—being an increase of 8,643,179 cubic feet as compared with the preceding year. The amount of unaccounted-for gas was 3,838,861 cubic feet, or 2 per cent.—being, the Committee believe, the lowest on record. Coals and other materials used in the manufacture of gas cost £8211, compared with £8504; and other costs of manufacture were £4527, compared with £4555. Distribution costs were £2948, compared with £2850; and management, £572, compared with £534. Rates and taxes amounted to £1116; the comparative figure for the previous year being £1125. Miscellaneous expenditure amounted to £83, compared with £324; bad debts (which are included in this figure) being £40, against £85. The figure on the present occasion is a record one since the Corporation took over the undertaking in 1878. The sale of gas produced £23,929, compared with £23,595. Residuals brought in £6478, compared with £7109; and miscellaneous receipts were £597, against £700. The total revenue for the year was £31,005, and the expenditure £17,459; leaving a gross profit of £13,546. This is slightly better than the previous year's record profit, and has been attained notwithstanding the reduction in the price of gas to power and other users which came into force at the commencement of the year, and affected the average receipts by rather over 1d. per 1000 cubic feet sold. Income-tax paid amounted to £501; and interest on capital (including interest on overdraft), was £2765. Loans repaid amounted to £4156; and depreciation funds were credited with £2102. After adding a small balance brought forward from the preceding year, the available balance is £4125. The Committee recommend that £2000 be transferred to the district fund in reduction of rates; that £1521 be carried to the reserve fund, and £50 handed over to the Free Library Committee; and that the balance, from which the bonus will be deducted, be carried forward. The Committee propose to transfer from the reserve fund the sum of £2171 to the credit of the suspense account, reducing this from £10,171 to £8000. The total expenditure upon capital account since the Corporation took over the works is £115,947. The loans repaid amount to £58,571; leaving the sum of £57,376 still owing. With this year's contributions, the total paid out of profits in aid of the rates and to the Free Library Committee will amount to £44,525.

The analysis prepared by the Engineer and Manager (Mr. Hubert Pooley) states that the make of coke per ton of coal carbonized (less breeze) was 12¾ cwt., of tar 12 gallons, and of sulphate of ammonia 25·9 lbs.; the net proceeds of the residuals being equal to 78·9 per cent. of the cost of coal, &c. The wages for carbonizing and for the manufacture of carburetted water gas were £1301, which was 1s. 7·280d. per ton of coal carbonized, and 1·685d. per 1000 cubic feet of gas sold. Repairs and maintenance of works were £2637, of mains and services, £1762, and of meters £909, or 3·414d., 2·281d., and 1·177d. respectively per 1000 feet of gas sold. The net cost of coal (less residuals) per 1000 feet of gas sold was 2·243d.; and the working expenses

11·968d.; making a total of 14·213d. The amount realized for the gas (after deducting £520, the cost of repairs to public lamps, &c.) was 30·974d. per 1000 feet sold; so that there was a profit of 16·761d. To this had to be added the profit on gas-fittings £435, and stove hire (less repairs) £162, making a gross profit of 17·535d. per 1000 feet sold.

The total expenditure on capital account for the Electricity Department is £32,641; and the loans repaid now are £7697, leaving an amount owing equal to £24,944. The total quantity of electricity sold by the department to all classes of consumers amounted to 303,402 B.T.U.; and this figure is made up as follows: For private consumers for lighting, &c., purposes, 146,129 units; for power, &c., 148,729 units; and for public lighting, 8544 units. There is an increase as compared with the previous year of 63,077 units, or 26·2 per cent. The equivalent in 8-candle power lamps connected during the year amounts to 2200, bringing up the total to 18,783, as compared with 16,583 the preceding year. The total revenue from all sources was £4134, as compared with £3537; and the expenditure was £1583, as compared with £1409. There is therefore a gross profit of £2551 7s. 3d., comparing with £2127. Depreciation on the main cables and battery will require £1400 this year. Interest on loans amounts to £902, and instalment of principal in reduction of capital to £1082. Income-tax is £79. The Committee have decided to ask a contribution from the rates equal to the amount of the loans repaid for the year—viz., £1082. The Committee are gratified to report that the department has earned a profit in excess by £485 of the sum required to meet income-tax, interest, and sinking-fund charges.

METROPOLITAN WATER BOARD.

Proposed Unification of Rates.

At the Meeting of the Board on Friday—Mr. J. B. P. Karslake (in the absence of the Chairman, Sir R. M. Beachcroft, through an accident) in the chair—the Appeal and Assessment Committee presented a long report on a proposed uniform scale of charges for water.

Under section 15 of the Metropolis Water Act, 1902, the Board are, within three years after the "appointed day" (June 24, 1904), to introduce into Parliament a Bill providing for "uniform scales of charges applicable throughout the limits of supply." The matter was some time ago referred to the above-named Committee, who, in May last year, reported that, having regard to the importance of the question, they had decided to invite the co-operation of the other Committees; and the result was that each of the standing Committees appointed two of their members for the purpose. A Sub-Committee was constituted to consider the scheme for a Bill, and they made an exhaustive report to the main Committee, who, after giving it most careful consideration, submitted their recommendations to the Board. They proposed that a maximum charge for domestic purposes should be fixed by the Bill, and that the domestic rate should include high service and the use of water for baths and water-closets. As to the basis on which the charge should be assessed, the Committee stated that, pending the application to the extra-Metropolitan areas of the system of quinquennial revaluation which prevailed in the Metropolis, they did not feel justified in suggesting any variation in the practice of determining the annual value for water-rate purposes as it now prevailed. The Committee had come to the conclusion that the domestic charges should not be graduated, but should be one rate in the pound, charged uniformly on the annual value of all properties; and they recommended accordingly. With regard to the question of the rate which should be fixed as the maximum charge for domestic purposes, they recommended that it should be 5 per cent. They showed that the general effect of this charge would be to bring in a revenue of £1,828,436, or £21,162 less than the revenue (£1,849,598) realized under the present conditions; the average percentage on the annual value being 5·06. The report also dealt with non-domestic charges, in regard to which the Committee recommended that the Board should, at the request of any person who was actually consuming water for domestic purposes within the limits of supply, afford to such consumer, at a price not exceeding 1s. per 1000 gallons, a supply of water for other than domestic purposes, on such terms and conditions as they thought fit. In conclusion, the Committee recommended that their proposals should be referred to the Law and Parliamentary Committee, with instructions to draft a Unification of Rates Bill for consideration and approval by the Board.

The report having been received, Mr. G. S. Elliott, the Chairman of the Committee, moved that it should be referred to the Finance Committee; and that in the meantime its consideration should be adjourned until the first meeting of the Board after the summer recess. This was agreed to.

Mr. Musgrave then proposed, in accordance with notice, the following resolution: "That the uniform scale of charge for domestic purposes should be based upon rateable value as fixed by the local authorities both within and without the Metropolis, and that it be an instruction to the Appeal and Assessment Committee to take the necessary steps to embody this principle in their scheme." He urged that the Board should come to a decision on the matter that day. There was some discussion on a point of order, as to whether the motion could be brought forward, the report having been referred to the Finance Committee and consideration of it adjourned. The Chairman, however, decided to take the motion, which was seconded by Mr. Burt.

Lord Welby, the Chairman of the Finance Committee, moved the following amendment: "That all words after the word 'That' in line 1 of the foregoing motion be omitted, and that the following be substituted therefor: 'the Board are not prepared to express any opinion on the matter referred to in such motion until full reports on the subject have been submitted to them, and that with this object the matter be referred to the Appeal and Assessment Committee and the Finance Committee for consideration and report.'" Mr. Pritchard seconded the amendment, which, after some discussion, was carried by 16 votes to 14.

The Board then adjourned for the summer recess.

INCOME-TAX ON MUNICIPAL UNDERTAKINGS.

A feature of our contemporary, the "Municipal Journal," is a collection of questions on legal matters, with answers supplied by a Barrister-at-Law. In the issue for the 13th inst., the above-named subject was dealt with, and the principle on which income-tax is assessed on municipal undertakings was explained. The question submitted was:

A Town Council, owing to a scarcity of water last summer, arranged to send down less compensation water than the law prescribes, for which it pays compensation to millowners of about £7000, charging the amount against the surplus account instead of revenue, thus showing a profit to this extent over what it would have been if charged to the revenue account. This gives rise to the following questions: (1) Under what Act or on what principles are municipal trading concerns, such as gas, water, tramways, and housing schemes, assessed and charged income-tax? (2) Can the loss on one undertaking of a corporation be set off against the profit on another?

To these questions the following reply was given: We do not clearly understand what is the account our correspondent refers to as the "surplus account." On the information submitted, however, it would appear that the £7000 in question should more properly be charged to revenue. It is, in effect, the price paid for water required for use during the year. Water-works and the various other municipal trading undertakings are liable to pay income-tax on the net amount of the yearly profit made, in pursuance of the Income-Tax Act, 1842. It is a question of fact in each case, to be settled by the Commissioners appointed under the Income-Tax Acts, as to what is the net profit on which the tax shall be paid, and how it is to be ascertained. It seems to us that the failure to charge the £7000 to revenue may not improbably result in the undertaking being assessed, in the first instance, at a higher figure than is just. On the other hand, the accounts are not necessarily conclusive for purposes of assessment; and it is open to the local authority to show that the apparent amount of net profit as shown in a particular account should, under the circumstances, be reduced by the sum of £7000. Profits arising from one undertaking of an authority may be set off against loss from another undertaking owned by the same authority, where the assessments are under Schedule D. But, generally speaking, the rule appears to be that each undertaking should be dealt with independently. As an illustration of the law relating to the assessment of income-tax on municipal undertakings or concerns, reference may be made to the case of *Attorney-General v. Scott* (28 L.T., 302). It was there held that the income of the City Corporation, including the profits derived from "profits of markets," "Mayor's Court," "corn and fruit metages," &c., is liable to income-tax, and that the proper principle on which deductions are to be allowed is to take each item or head of income separately, and assess the income-tax upon the net value of such item after deducting from its gross receipts the costs incurred in earning it. But apparently no deduction can be allowed in respect of the general expenditure for keeping up the establishment of the Corporation.

LONDON COUNTY COUNCIL AND ELECTRICITY SUPPLY.

A Bulk Scheme to be Prepared.

At the Meeting of the London County Council last Tuesday, the Highways Committee reported that they were giving careful consideration to the report of the Select Committee on the London County Council (Electric Supply) Bill, 1906, and also to the report made to that Committee by the Board of Trade. Having regard to the terms of these reports, they were of opinion that the Council should lose no time in preparing a scheme to be laid before Parliament dealing with the supply of electricity in bulk in London and the surrounding districts. They would not be in a position to report fully on the whole subject until after the summer vacation, and in the meantime they recommended as follows: "(1) That the operation of the Standing Orders be suspended to allow the Committee to recommend the Council after the summer vacation to promote a Bill in Parliament dealing with the supply of electricity in bulk in London and the surrounding districts. (2) "That the Committee be authorized to take such action as is necessary in order that a scheme for the supply of electricity in bulk may be submitted to the Council; that the special maintenance estimate of £1500, submitted by the Finance Committee, be approved; and that expenditure not exceeding this amount be sanctioned." The Finance Committee reported that, having considered in its financial bearings the above estimate, they submitted the same as chargeable to maintenance account. It would devolve upon them in due course to report upon the financial aspects of proposals when they had been formulated; but, in the meantime, they would place themselves in communication with the Highways Committee.

The presentation of the report gave rise to a long discussion, in the course of which Sir R. M. Beachcroft strongly criticized the proposal of the Committee to have a free hand to bring up whatever scheme they chose for an enterprise of the magnitude of the one in question. Opposition to the recommendations was offered by several other members; but the Labour representatives supported them. A division took place on the first recommendation, with the result that it was adopted by 75 votes to 33. The Standing Orders having been suspended, Sir R. M. Beachcroft moved the following amendment to the second recommendation: "This Council, being of opinion that a cheap supply of electricity for London and the neighbouring districts can be obtained at private risk under conditions that will safeguard public interests, is not prepared to introduce a Bill in the next session of Parliament which will compel the Council to undertake a speculative enterprise involving enormous financial responsibilities." Mr. R. A. Robinson seconded the amendment, which was supported by Mr. Anstruther and Mr. E. Collins. After some discussion, it was rejected by 67 votes to 32, and the recommendation of the Committee was adopted.

The Directors of the Weardale and Consett Water Company have decided to pay an interim dividend at the rate of 5 per cent. per annum, being the same as for the corresponding period of last year.

MANCHESTER WATER SUPPLY.

A Third Pipe to be Laid from Thirlmere.

The question of the laying of a third pipe from Thirlmere was discussed by the Manchester City Council at their meeting last Wednesday, when the confirmation was proposed of a resolution passed by the Water Committee that, in view of the continued increase in the consumption of water, and the time necessary to carry out the work, arrangements should be forthwith made for the laying of the third pipe in connection with the Thirlmere aqueduct.

Sir Bosdin T. Leech, the Chairman of the Water Committee, who moved the resolution, remarked that the consumption lately had been growing at a very rapid rate, in consequence of the increased population and other causes. During the six months of the present year, the average daily increase over last year had been 1½ million gallons. This, together with the introduction of water carriage for sewage, had completely upset the calculations of thirty years ago, and would oblige Manchester to look out for a new source of supply much earlier than was expected. If the wishes of the Council as to sewage were carried out, it would mean an additional use of 17 to 18 million gallons of water per week. A part of the cost of laying the new pipe had been anticipated in the laying of the second pipe. When making passages through rock, they sometimes made them wide enough to admit of a third pipe without further blasting. The estimated cost of the third pipe was about £750,000. The Committee possessed borrowing powers to the extent of £650,000; and the balance would be the subject of an application to Parliament hereafter. An aqueduct connected with the third pipe to carry water from Little Hulton to the reservoirs at Audenshaw had already been sanctioned. It was necessary to obtain this in advance, because the district was being so rapidly built over. The surplus water would for the present be dealt with at Audenshaw; but a new service reservoir would have to be constructed.

A short discussion took place; and an amendment was moved that two pipes, instead of one, should be laid. Sir Bosdin Leech, however, pointed out that it would be absolute extravagance to do this. The amendment was thereupon rejected, and the resolution was agreed to.

DEVONPORT WATER-WORKS PURCHASE.

The Transfer of the Undertaking.

A report was presented to the Devonport Town Council last Thursday week respecting the transfer of the undertaking of the Devonport Water Company. The Town Clerk handed to the Solicitor of the Company on June 30 cheques for the purchase money and costs, and the Company handed over their deeds, books, plant, stock, &c. The Company also gave the Town Clerk a cheque for £1408 3s. 10d., the amount of the unspent capital of the Company, and also plant and stores purchased out of capital to the value of £2011 9s. 2d. A statement prepared by the Borough Treasurer gives the following as the total cost of the acquisition of the undertaking.

Purchase money	£239,020 0 0	
Less unspent capital handed over by the Company, and stores and plant purchased out of capital	3,419 13 0	
		£235,600 7 0
Costs paid to the Company		4,980 0 0
Costs of winding up paid to the Company		250 0 0
One-half costs of Company's Bill . . .		1,899 18 11
Costs incurred by the Corporation in the arbitration and special case . . .		7,235 6 9
Stamp duty on transfer		1,195 5 0
		£251,160 17 8

The Water Committee decided to borrow the above sum.

In addition to the amount named, the Corporation also take over the mortgage and debenture debt of the Company, the amount of which is £28,250; and this becomes a first charge upon the undertaking. A list was presented of the officials of the Company whose services will be retained by the Corporation, and of those whose connection with the undertaking will cease. Among the latter are Mr. Foster J. Bone, Secretary and Solicitor, to whom the Corporation will pay £210 per annum as compensation for loss of office, and Mr. H. Francis, the Engineer and Manager, who is to receive £400 per annum.

The Distribution of the Purchase Money.

A meeting of the stockholders of the Water Company was held last Tuesday, for the purpose of considering the scheme set out in last week's "Journal" (p. 126) for the distribution of the money received from the Corporation for the purchase of the undertaking. Mr. T. Bulteel, the Chairman, presided, and explained that the scheme was based on the report of Mr. William Cash, of Messrs. Cash, Stone, and Co. It had received the anxious consideration of the Directors, who had done all in their power to make it equitable. From the proxies, it appeared to have given general satisfaction; and he proposed that it be adopted.

Mr. C. L. Duke, the Chairman of the Finance Committee of the Plymouth Corporation, who are holders of £10,169 of 4 per cent. preference stock, objected to the scheme, and pointed out that under it the Corporation would receive only £12,355, instead of £12,797 paid for the stock. The Corporation submitted that they were entitled to the full amount paid for the stock, or at least a sum equal to the minimum price fixed by the Company at the time when the stock was sold by auction. In the opinion of the Corporation, the share of the purchase-money allotted to the holders of ordinary stock was too high, and they also regarded the sum to be retained by the Directors as excessive.

Mr. H. Banbury, the Chairman of the Finance Committee of the Devonport Corporation, took a like objection. The Devonport Corporation hold £1712 of the 4 per cent. preference stock, which was purchased for £2288; and the loss of capital under the scheme proposed would be £208. Mr. E. A. Hankey, another holder, also objected.

The Chairman pointed out that securities fluctuated in value, and said that if the Plymouth and Devonport Corporations had invested in Consols or in their own stock, they would have lost more than under this scheme.

Mr. Foster Bone, the Secretary and Solicitor to the Company, said the holders of the preference stock had been very generously treated, as they would receive under the scheme sufficient to pay themselves the maximum dividend, with a fair allowance for temporary loss of interest and the cost of reinvestment. The ordinary stockholders would not be compensated for the £47,000 arrears of dividend unpaid. As objection had been made, the matter would have to go before Mr. Samuel Wood, of Messrs. Wood, Drew, and Co. Mr. Wood was the Accountant engaged by the Devonport Corporation for the arbitration proceedings, and, like Mr. Cash, was well acquainted with the figures. This meant delay in settling the matter, and it meant further costs.

Mr. J. Bayly, a Director, said that the Board had for some time adopted a conservative policy, and had paid 5 per cent. on the ordinary stock when they might have paid 7 per cent. They had thus built up the undertaking out of revenue. Having regard to this, Mr. Cash might have considered that the ordinary stockholders were entitled to what perhaps seemed a large amount.

Mr. Bone promised to communicate with Mr. Wood and with the objectors to the scheme, and the proceedings ended.

The Water Committee proceeded last Wednesday to carry out the inspection of the works; but during the journey over Dartmoor one of the members—Mr. J. Semmens—was taken ill and died. In consequence of this sad event, the inspection was deferred to another day. At the inquest, it was shown that Mr. Semmens had suffered from disease of the heart, and that death was caused by the exertion of walking up a steep hill on a hot day.

NOTES FROM SCOTLAND.

From Our Own Correspondent.

Saturday.

The official programme of the meeting of the North British Association of Gas Managers, as issued by Mr. R. S. Carlow, of Perth, the Secretary, has been considerably modified since the preliminary announcement was made in the "Journal" for May 22 last. The excursion to Kelso has been dropped—it is understood on account of catering difficulties. This allows the projected visit to the Granton Gas-Works to be made on Friday afternoon, which was to have been made on Thursday, and consequently leaves the full time for the General Meeting. The forenoon of Friday is to be filled in by a drive to the Forth Bridge. I do not know whether it may be arranged for or not; but if permission could be got to drive through the grounds of Dalmeny, either in going or returning, not only would the route be pleasantly varied, but gas managers would have the pleasure of seeing some magnificent specimens of crops grown with sulphate of ammonia as a manure. The papers to be read at the meeting are three in number, and should afford material for a good day's work.

A special article, which it is manifest has been written of design, and by one who is not conversant with the circumstances, upon the old gas-works in Edinburgh and their chimney, was published in the "Scotsman" on Thursday. The writer professes to be the oracle of "a few citizens," who are "wondering if the city will get rid of the huge chimney which is so great an eyesore in the view of the valley." "Those," it is asserted, "who concern themselves about the amenity of the city, have never been reconciled to its presence, standing as it does, bare and gaunt, against the view of Salisbury Crags and the northern spur of Arthur's Seat." He admits that there has been a chimney there since about 1818, which brings out the long-suffering nature of the amenity party; but then he goes on to say that the first chimney, which was taken down a few years ago, gave way in its foundations "in consequence, it was supposed, of the diversion of subterranean water by the formation of so many wells at the new breweries at Duddingston." It would surely be strange if the new wells more than a mile away should have fastened upon the gas-works chimney as their victim, and have left quite unharmed so many tall buildings, of various descriptions, between and around. Those who are acquainted with the circumstances, attribute the collapse of the chimney to conditions of a much more local character, which need not be gone into here. The ostensible purpose of the article is to secure that the Gas Commissioners, when they dispose of the old works, will make a stipulation that the purchaser shall remove the chimney, and not only that, but shall prohibit the erection of any other chimney, great or small, on the ground. He might have saved himself the trouble of writing, because the Gas Commissioners have already resolved that the chimney is not to be taken down, as they consider it a valuable asset, and wish to sell the site with the advantage which it affords.

There was an echo this week of the agitation over the smells which are complained of as emanating from the Granton Gas-Works; but it is getting fainter. The Public Health Committee of the Edinburgh Town Council resolved on Tuesday to forward to the Local Government Board for Scotland copies of the reports upon the subject by the Medical Officer of Health (Sir Henry Littlejohn) and the Chief Sanitary Inspector (Dr. A. M. Williamson). This action has been taken at the request of the Local Government Board. The reports by the two officials have not been made public; but it is stated that, while Sir Henry Littlejohn has found that no nuisance exists, Dr. Williamson is still more emphatic.

The shareholders of the Montrose Gaslight Company held their annual meeting on Wednesday—Mr. A. Muirden presiding. Mr. A. Mackay, the Secretary and Manager, reported that during the year the quantity of gas manufactured amounted to 30,156,500 cubic feet—an

increase of over 800,000 cubic feet. Additional ordinary meters fixed numbered 196; prepayment meters, 282; cookers, 42; and grillers, gas-fires, and other appliances, 380. Unaccounted-for gas showed a reduction. As recommended by the Directors, a dividend at the rate of £2 per share—an increase of 2s. 6d.—was declared; and a balance was carried forward, which will go far to meet the expense of a new sulphate plant which is in course of construction. The retiring Directors, and the Secretary and Manager, were re-elected.

The Town Council of Peebles have voted an honorarium of £250 to Mr. A. Bell, jun., their Gas Manager, in respect of extra work in connection with the new gas-works, which were opened a year ago. At the last monthly meeting of the Council, a letter from Mr. Bell was read, thanking them for the award.

The Brechin Gaslight Company, Limited, held their annual meeting (embracing a period of thirteen months, since the Company was reconstructed) on Wednesday. It was reported that the balance at the credit of the profit and loss account, after providing for the depreciation of the works, dividend on preference shares, &c., amounted to £1124. The Directors recommended that £980 be applied in paying a dividend at the rate of 7 per cent., free of income-tax, on the ordinary shares, leaving £144 to be carried forward, subject to the remuneration of the Directors. The income from gas was £4759, and the total income £6141. The Chairman (Mr. J. Guthrie, J.P.) said they had supplied 200 cookers in addition to those already in use. The income from prepayment meters was £1961, as compared with £1613 the previous year. There were 1130 of these meters in use; the average collection from each of which was £1 14s. 9d. The increase in the income was almost phenomenal. Though they had lost their biggest private consumer, there had been an increase in the consumption of gas of over a million cubic feet. The expenditure had been fairly heavy, in consequence of a good many extra items in connection with the reconstruction of the Company; but these would not occur again. They proposed to retain the price of gas at 4s. 4d. per 1000 cubic feet for lighting purposes, and 3s. 6d. for power and domestic uses. The recommendations of the Directors having been adopted, the Chairman went on to say the Board proposed to issue another 100 shares of £10 each. These would be put out at £11, and the extra £100 raised thereby would pay off the £100 still owing upon reconstruction expenses. As to the proposed amalgamation with the Edzell Gas Company, he considered that the benefit would be on the side of Edzell. As an Edzell shareholder, he would be in favour of it; but as a Brechin shareholder, he was against it, though he could see that in the course of time something would be gained by amalgamation. It was agreed that no further action in the matter of amalgamation should be taken in the meantime; but that the Directors should have power to consult with the Edzell Company, if the latter wished a meeting. At a meeting of Directors held immediately afterwards, the Chairman expressed the thanks of the Company to the Engineer and Manager (Mr. Allan Reid) for the satisfactory results of the past year, and intimated that they had agreed to increase his salary by £20.

The Saltcoats Gas Company, Limited, held their annual meeting on Tuesday—Mr. T. Kirkhope in the chair. The report of the Directors showed a balance at the credit of the profit and loss account of £1418. On their recommendation, a dividend at the rate of 7½ per cent., free of income-tax, absorbing £1200, was declared, and £218 was carried forward. The price of gas was continued at 3s. 4d. per 1000 cubic feet. The revenue from gas is still increasing; the amount being £4056. The total revenue was £4877. Depreciation, at the rate of 3 per cent., amounted to £478. During the year 66 new meters were added. The coal used was 2492 tons; and the gas produced was 26,181,100 cubic feet, or at the rate of 9943 feet per ton. Unaccounted-for gas, as might be expected, was very low, amounting to only 5 per cent.

The Annan Gaslight Company held their annual meeting on Thursday—Mr. T. H. Foster presiding. It was reported by the Directors that the total revenue for the year was £3138, and the expenditure £2477, which left a balance of £661. The disposable balance was £789. The Directors recommended a dividend of 6 per cent., free of income-tax, and that the balance of £149 should be carried forward. The expenditure on capital account during the year amounted to £1024, the additions including about half an acre of ground which had been acquired on feu, and on which have been erected buildings in which to carry on the manufacture of sulphate of ammonia. The gas made during the year amounted to 16,526,500 cubic feet—an increase over the previous year of 1,700,100 cubic feet. The Chairman said that sulphate manufacture was a new venture, which had the approval and recommendation of their Engineer (Mr. J. Hepworth) and their Manager (Mr. R. M'Gill). The vitality of the Gas Company was well illustrated by the figures of the internal working; and they might rest assured that the prosperity in the future was not likely to diminish, but rather to increase. The report of the Directors was adopted.

At the annual meeting of the Selkirk Gaslight Company on Tuesday of last week, the report of the Directors, referred to the previous week, was adopted. A proposal to double the capital of the Company was dropped; there being no seconder to it. To the motion that the price of gas remain at 2s. 8½d. per 1000 cubic feet, Mr. Sim, who represented the burgh interest in the Company, moved that the charge be reduced, as they could quite well afford it. There was, however, no seconder to this; and consequently the price will remain at the old figure.

On Thursday the new sulphate plant, which has been erected at the Kilsyth Corporation Gas-Works by the Chemical Engineering Company, was formally inaugurated by Provost Stark unlocking the door of the house in which the plant is located. The total cost of the building, plant, and appliances will scarcely reach £500. In speeches which were made, credit for keeping within the estimate, and for the excellence of the work, was given to the Manager for the Contractors (Mr. Shadbolt), and to the Gas Convener (Mr. J. Jarvie) and the Gas Manager (Mr. W. Kellock). The plant appears to be of the most up-to-date description.

The Falkirk Town Council on Monday resolved, on the recommendation of the Gas Manager (Mr. W. M'Crae), to dispose of part of the old plant at the disused gas-works. Mr. M'Crae was instructed to proceed with the erection of permanent offices at the new gas-works, which have not yet been provided. The Manager recommended the erection of a holder and tank in the new gas-works; and the Council instructed him to get in offers and specifications for the work.

This week an inquiry has been held in Edinburgh, under the Private Legislation Procedure (Scotland) Act, 1889, into an application for power to augment the water supply of Blairgowrie and district. It is proposed to form a Water Trust out of the membership of the Eastern District Committee of the County Council of Perth, and the Town Councils of Blairgowrie and Rattray, and to derive water for the whole area represented by raising by 3 feet the level of Loch Benachally The water supply of the burghs is at present obtained from the loch, but it is inadequate for both places; and it being necessary to provide

GAS COMPANIES' STOCK AND SHARE LIST.

Referred to on p. 226.

Issue.	Share.	When ex-Dividend.	Dividend or Dividend & Bonus.	NAME.	Closing Prices.	Rise or Fall in Wk.	Yield upon Investment.
£			p.c.				£ s. d.
590,000	10	Apl. 11	10½	Alliance & Dublin 10 p.c.	20—21	..	5 0 0
160,000	10	,,	7½	Do. 7 p.c.	14⅛—15½	..	4 16 9
200,000	5	May 11	7	Bomb'ay, Ltd.. . . .	6⅞—7⅛	..	4 16 7
40,000	5	,,	7	Do. New, £4 paid	4⅞—5⅛	..	4 16 8
50,000	10	Mch. 9	14	Bourne-) 10 p.c. . .	28½—29½	..	4 14 11
51,810	10	,,	7	mouth Gas) B 7 p.c. .	17—18	..	3 17 9
53,200	10	,,	6	and Water) Pref. 6 p.c.	15—16	..	3 15 0
380,000	Stk.	Feb. 22	12½	Brentford Consolidated	263—268	..	4 13 3
300,000	,,	,,	9⅜	Do. New . . .	200—205	..	4 12 8
50,000	,,	,,	5	Do. 5 p.c. Pref. .	123—128	..	3 16 11
206,250	,,	June 14	4	Do. 4 p.c. Deb. .	103—106	..	3 15 6
220,000	Stk.	Mch. 9	11¼	Brighton & Hove Orig.	230—235	..	4 15 9
246,320	,,	,,	8¼	Do. A. Ord. Stk. .	165—170	..	4 17 1
460,000	20	Apl. 11	10	British	41½—42½	−½	4 14 1
100,000	Stk.	Feb. 22	6	Bromley, Ord. 5 p.c. .	121—124	..	4 16 9
165,700	,,	,,	4½	Do. do. 3½ p.c. .	92—95	..	4 14 9
500,000	10	May 11	7	Buenos Ayres (New) Ltd.	11½—12	..	5 16 8
250,000	Stk.	June 28	4	Do. 4 p.c. Deb. .	96—98	..	4 1 8
150,000	20	July 12	8½	Cagliari, Ltd.	24—26*	..	6 6 11
100,000	10	June 14	10	Cape Town & Dis., Ltd.	15½—16½	..	6 1 3
100,000	10	Apl. 26	4½	Do. 4½ p.c Pref.. .	9¾—10¼	..	4 7 10
50,000	50	May 2	6	Do. 6 p.c. 1st Mort.	52—54	..	5 11 1
50,000	Stk.	June 28	4½	Do. 4½ p.c. Deb. Stk.	58—100	..	4 10 0
1,443,280	Stk.	Feb. 22	5⅛	Commercial 4 p.c Stk. .	114—116	+1	4 9 7
560,000	,,	,,	5	Do. 3½ p.c. do. .	111—113	+1	4 8 6
475,000	,,	June 14	3	Do. 3 p.c. Deb. Stk.	84—86	..	3 9 9
800,000	Stk.	,,	6½	Continental Union, Ltd.	124—127	..	5 2 4
200,000	,,	,,	7	Do. 7 p c. Pref.	140—145	..	4 16 7
432,070	Stk.	Feb.	5½	Derby Con. Stk. . . .	122—124	..	4 8 9
55,000	,,	Jan.	4	Do. Deb. Stk. . . .	105—107	..	3 14 9
486,090	10	Jan. 25	11	European, Ltd. . . .	24½—25½	..	4 6 3
354,060	10	,,	11	Do. £7 10s. paid	18½—19½	..	4 4 8
15,223,235	Stk.	Feb. 8	4⅕	Gas-) 4 p.c. Ord. . .	100—102	+2½	4 6 3
2,600,000	,,	,,	3½	light) 3½ p.c. max. . .	88—90	..	3 17 9
3,799,735	,,	,,	4	and) 4 p.c. Con. Pref.	108—111	..	3 12 1
4,193,975	,,	June 14	3	Coke) 3 p.c. Con. Deb.	86—88	..	3 8 2
258,740	Stk.	Mch. 9	5	Hastings & St. L. 3½ p.c.	100—105	..	4 15 3
82,500	,,	,,	6½	Do. do. 5 p.c.	121—124	..	5 4 10
70,000	10	Apl. 11	11	Hongkong & China, Ltd.	20—21	..	5 4 9
4,940,000	Stk.	May 11	8	Imperial Continental .	178—180	+1	4 8 11
473,600	Stk.	Feb. 8	3½	Do. 3½ p.c. Deb. Red.	96—98	..	3 11 5
175,242	Stk.	Mch. 28	6	Lea Bridge Ord. 5 p.c. .	121—126	..	4 15 3
561,000	Stk.	Feb. 22	10	Liverpool United A . .	235—237	..	4 4 5
718,100	Stk.	Feb. 22	7	Liverpool United B .	169—171	..	4 1 10
306,083	,,	June 28	4	L'rpool Unit'd Deb. Stk.	107—109	..	3 13 5
75,000	5	June 28	5	Malta & Medn., Ltd. .	4⅛—4⅜	..	5 5 3
560,000	100	Apl. 2	5	Met. of) 5 p.c. Deb..	103—105	..	4 15 3
250,000	100	,,	4½	Melbourne) 4½ p.c. Deb.	102—104	..	4 6 7
541,920	20	May 31	3½	Monte Video, Ltd. . .	11—12	..	5 16 8
1,675,892	Stk.	Feb. 22	4⅝	Newc'tle & G'tesh'd Con.	110—112	..	4 2 7
406,625	Stk.	June 29	3½	Do. 3½ p.c. Deb.	97—99	..	3 10 8
15,000	10	Mch. 9	10	North Middlesex 10 p.c.	19½—20½	..	4 17 7
52,940	10	,,	7	Do. 7 p.c.	13—14	..	5 0 0
300,000	Stk.	May 11	8	Oriental, Ltd. . . .	150—153	+3	5 4 7
600,000	5	Mch. 28	7	Ottoman, Ltd. . . .	6—6⅛	..	5 7 8
398,490	5	Apl. 26	7	Primitiva Ord. . . .	6⅛—6⅜	..	5 3 8
796,980	5	Jan. 25	5	Do. 5 p.c. Pref. .	5⅛—5⅜	..	4 13 0
488,900	100	June 1	4	Do. 4 p.c. Deb. .	95—97	..	4 2 6
851,070	10	Apl. 26	7	River Plate Ord. . . .	12½—13	+⅛	5 7 8
300,000	Stk.	June 28	4	Do. 4 p.c. Deb. .	96—98	..	4 1 8
250,000	10	Mch. 28	8	San Paulo, Ltd. . . .	13¾—14¼	+⅛	5 12 3
70,000	50	July 2	5	Do. 5 p.c. Deb. .	49—51	..	4 18 0
135,000	Stk.	Mch. 28	10	Sheffield A	244—246	..	4 1 4
209,984	,,	,,	10	Do. B	243—245	..	4 1 8
523,498	,,	,,	10	Do. C	243—245	..	4 1 8
126,106	Stk.	Mch. 9	5½	Shrewsbury Ord. 5 p.c.	114—116	..	4 14 10
70,000	10	May 31	10	South African	15½—16½	..	6 1 3
6,250,000	Stk.	Feb. 22	5½	South Met., 4 p.c. Ord.	132—134	+3	4 2 8
1,895,445	,,	July 12	3	Do. 3 p.c. Deb.	86—88*	..	3 8 2
575,000	Stk.	Mch. 9	5½	S'th Suburb'n Ord. 5 p.c.	124—127	+2	4 6 8
60,000	,,	,,	5	Do. 5 p.c. Pref. . .	125—130	..	3 16 11
112,533	,,	July 12	5	Do. 5 p.c. Deb. Stk.	130—135*	..	3 14 1
502,310	Stk.	May 11	5	Southampton Ord. . .	107—112	..	4 9 3
120,000	Stk.	Mch. 9	6½	Tottenham) A 5 p.c. .	124—127	..	4 18 5
363,020	,,	,,	4½	and) B 3½ p.c. .	99—102	..	4 13 2
137,500	,,	June 28	4	Edmonton) 4 p.c. Deb.	103—105	..	3 16 2
182,380	10	June 14	8	Tuscan, Ltd.	10—10½	..	7 12 5
149,900	10	July 2	5	Do. 5 p.c. Deb. Red.	98—101	..	4 19 0
30,000	Stk.	Feb. 22	7⅞	Wands-) A 5 p.c. . .	—	..	—
255,636	,,	,,	6¼	worth) B 3½ p.c. . .	133—136	..	4 11 11
75,000	,,	,,	5⅞	and) C 3½ p.c. . .	110—113	..	4 16 1
69,416	,,	June 28	3	Putney) 3 p.c. Deb. Stk.	82—85	..	3 10 7
745,872	,,	Mch. 9	5⅛	West Ham 5 p.c. Ord. .	106—108	..	4 14 10
185,000	,,	,,	5	Do. 5 p.c. Pref. . .	122—125	..	4 0 0
193,300	,,	June 28	4	Do. 4 p.c. Deb. Stk.	104—107	..	3 14 9

Prices marked * are "Ex div."

water for the populous district of Rosemount, in the county, the three Local Authorities have combined in the promotion of one scheme. The population to be served numbers nearly 11,000; and the quantity of water available will be raised from 750,000 to 1,346,000 gallons per day. Objections to the scheme were taken by Colonel Campbell of Achalader, a landowner, who considered that the compensation water offered was not sufficient, and by Mr. J. Grimond, a mill-owner, who drives his machinery by water from the loch, and who asserted that his mills would require to be closed unless he were allowed to control the water available from it. The Commissioners found the preamble proved; rejecting Colonel Campbell's contention, and making it a condition that Mr. Grimond should be repaid a sum of £179 which was expended on the raising of the level of the loch as long ago as the year 1871.

CURRENT SALES OF GAS PRODUCTS.

Week ending July 21.

Sulphate of Ammonia.

LIVERPOOL, *July 21.*

Although there has been a quiet tone about the market, parcels offered have been readily taken up, and the closing quotations remain £11 12s. 6d. per ton f.o.b. Hull, and £11 15s. per ton f.o.b. Liverpool and Leith. The purchasing has, however, been mainly for covering contracts for July delivery, and direct orders have been scarce. In the forward position there has been increased interest, and a fair amount of business has been done; but the firmness of makers for 1907 has restricted transactions in that position. £12 2s. 6d. per ton is reported to have been paid for October-March delivery, and there would probably still be sellers at this price, but makers are more concerned about selling nearer months, for which they quote £12 per ton.

Nitrate of Soda.

This article is quiet but steady at 11s. 1½d. per cwt. for 95 per cent., and 11s. 4½d. per cwt. for refined quality.

Tar Products.

LONDON, *July 21.*

The market remains in about the same position. Pitch is firm for forward delivery; but there does not appear to have been very much business doing lately, the prices asked by makers being too high to interest buyers. The principal London makers still ask 32s., and report having refused 30s.; but on the other hand, the latter price would probably be accepted by other London distillers. Business is reported in the North at 28s. 6d.; but several of the makers are holding out for 29s., and even 30s., and are evidently not at all anxious to sell. It is reported that 32s. 6d. has been paid in South Wales for a small quantity for September-December; but most of the consumers in this district are well bought up to the end of the year, and are only interested for January-June. It appears quite impossible just at present to obtain satisfactory prices from Continental buyers, who all seem to think they will do better by waiting. There is practically no change in creosote. London makers are well sold; and as there is still a good demand from America, they do not care to place any further quantity except at an advance upon existing prices. Makers in the Midlands are disposed to accept 1½d. for salty oil at their works; while for ordinary liquid oil they ask 1⅝d., but consumers are not disposed to pay this price. The position of anthracene remains unchanged. A small quantity of 40 per cent. was sold at 1¼d. per unit; while it is reported that 1¾d. was realized in London for a fairly good quality. Solvent naphtha is firm. London makers are well sold forward, and are getting a good price for the small quantities which they are able to spare. For a small quantity for prompt delivery 1s. 2d. was paid, and this may be taken as about the ruling price for London makes. The market remains unchanged in carbolic acid. A small parcel of 70's was sold at the equivalent of 1s. 10½d. on the east coast, and a parcel of 65's at the equivalent of 1s. 9½d. The German consumers at present refuse to offer more than 1s. 9d. for 60's, which price it is impossible to get makers to accept. In crystals, there is very little doing; and prices remain unchanged. Toluol continues very firm. London makers ask 1s. 2d., casks included, for small quantities; while business has been done in the Midlands at 11d. naked. Benzol 90 per cent. remains quiet. A fair quantity was sold *ex* works in the North at 7d. naked for delivery over the last four months of the year. 50-90 per cent. is, however, scarce, and sales are reported at 11d. per gallon.

The average values during the week were: Tar, 15s. to 20s. Pitch, London, 27s. 6d.; east coast, 26s. 6d.; west coast, 25s. 6d. to 25s. 9d. Benzol, 90 per cent., 9d. to 9½d.; 50-90 per cent., 11d. Toluol, 1s. 1d. to 1s. 2d. Crude naphtha, 3¾d. to 4d.; solvent naphtha, 1s. 1d. to 1s. 2d.; heavy naphtha, 11½d. to 1s. 0½d. Creosote, London, 1 15/16d. to 2 1/16d.; North, 1½d. to 1⅝d. Heavy oils, 2¼d. Carbolic acid, 60 per cent., 1s. 9d. to 1s. 9½d. Naphthalene, £4 10s. to £9 10s.; salts, 25s. Anthracene, "A" quality, 1½d. to 1¾d.; "B" quality, unsaleable.

Sulphate of Ammonia.

There has been a decided improvement in this article during the past week, and prices have improved from 2s. 6d. to 3s. 9d. per ton all round. London makers still quote £12, and report that they could obtain this price for September-December. In Leith, £11 15s. is reported to have been paid for prompt, and £11 17s. 6d. refused for forward delivery. In Hull, £11 12s. 6d. has been offered for immediate delivery, and £11 16s. 3d. has in one instance been refused for forward. In Liverpool, the market value may be taken as from £11 13s. 9d. to £11 16s. 3d.; and here also dealers are anxious to buy forward at existing prices, but they find it impossible to do so.

CARBURETTED WATER-GAS APPARATUS

Merrifield—Westcott—Pearson Patents.

The Economical Gas Apparatus Construction Co., Ld.

W. H. PEARSON, Chairman.
W. H. PEARSON, Junr., Deputy-Chairman.
J. T. WESTCOTT, Manager.
L. L. MERRIFIELD, M.Inst.M.E., Engineer.

London Offices: 19, ABINGDON STREET, WESTMINSTER, S.W.
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CARBURETTED WATER-GAS ENGINEERS.

The above Company have erected since 1893, or are now erecting, their Universal Type of Carburetted Water-Gas Plant at the following Gas-Works:—

	Cub. Ft. Daily.		Cub. Ft. Daily.		Cub. Ft. Daily.
Blackburn	1,250,000	Winnipeg, Man.	500,000	Malton	150,000
Windsor St. Works, Birmingham	2,000,000	Colchester (Second Contract)	300,000	Smethwick	500,000
Saltley Works, Birmingham	2,000,000	York	750,000	Gravesend	300,000
Colchester	300,000	Rochester	500,000	Pernambuco, Brazil	125,000
Birkenhead	2,250,000	Kingston, Ont.	300,000	Duluth, (Second Contract)	300,000
Swindon (New Swindon Gas Co.)	120,000	Crystal Palace District	2,000,000	Leicester (Second Contract)	1,000,000
Saltley, Birmingham (Second Contract)	2,000,000	Duluth, Minn.	300,000	Newport (Second Contract)	250,000
Windsor St., Birmingham (Second Contract)	2,000,000	Caterham	150,000	Brockville	250,000
Halifax	1,000,000	Leicester	2,000,000	Toronto (Third Contract)	750,000
Toronto	250,000	Enschede, Holland	150,000	Montreal, Ont. (Second Con.)	1,800,000
Ottawa	250,000	Buenos Ayres (River Plate Co.)	700,000	Toronto (Fourth Contract)	1,000,000
Lindsay (Remodelled)	125,000	Burnley	1,500,000	Hamilton, Ont.	400,000
Montreal	500,000	Kingston-on-Thames	1,750,000	Rochester (Third Contract)	1,600,000
Toronto (2nd Cont., Remodelled)	2,000,000	Accrington	500,000	Leeds (Second Contract)	900,000
Belleville	250,000	Tonbridge	300,000	Buenos Ayres (Primitiva Co.)	1,200,000
Ottawa (Second Contract)	250,000	Stretford	500,000	Buenos Ayres (New Co.)	1,200,000
Brantford (Remodelled)	200,000	Oldbury	300,000	Christchurch, N.Z.	300,000
St. Catherines (Remodelled)	250,000	Todmorden	500,000	Rochdale	1,600,000
Kingston, Pa.	125,000	Saltley, Birmingham (Third Contract)	2,000,000	St. John's, Newfoundland	250,000
Peterborough, Ont.	250,000	York (Second Contract)	750,000	Brantford (Second Contract)	400,000
Wilkesbarre, Pa.	750,000	Rochester (Second Contract)	500,000	Smethwick (Second Contract)	500,000
St. Catherines (Second Cont.)	250,000	Newport (Mon.)	250,000	Pontypridd	250,000
Buffalo, N.Y.	2,000,000	Tokio, Japan	1,000,000	Montreal (Third Contract)	1,800,000
		Newcastle-on-Tyne	1,800,000	Guelph, Ont.	350,000
		Leeds	1,800,000	Buenos Ayres (River Plate Co.) Second Contract	750,000
				Belgrano (River Plate Co.)	500,000

And, in addition, COAL GAS PLANTS at NELSON, B.C., CHATHAM, BERLIN, NAPANEE, OWEN SOUND, CALGARY, and WINNIPEG

COAL TRADE REPORTS.

Lancashire Coal Trade.

Gas-cooking stoves and gas-fires just now suffice for the domestic wants and comfort of the bulk of the inhabitants in Lancashire towns; and as a consequence gas coal and cannel continue in moderate request. In most cases, the supply is by contract, with deliveries by arrangement. House coal is having a slow sale; and its small requirement necessarily diminishes the amount of slack made. Slack is therefore becoming scarce. Engine fuel is in good demand. Furnace coke commands good prices. A fair amount of coal for steamers is going down to the Ship Canal, and a steady export trade is being done, chiefly with Manxland and Ireland. A local colliery company have just secured an advance of 6d. per ton on shipping coal of superior quality. Average quotations remain unaltered.

Northern Coal Trade.

There is a stronger demand for coal, and the production is in some cases a little interfered with by local holidays, so the output is well taken up. In the steam coal trade, the shipments are heavy; and thus the prices are well upheld. Best Northumbrian steams find a good sale at 10s. 6d. per ton f.o.b., and occasionally a slightly higher price is asked. Second-class steams are from 9s. 9d. to 10s., and steam smalls are firm at 6s. to 6s. 3d.—the latter kind being still rather scarce. In the gas coal trade, there is now a steadier inquiry. The deliveries on large contracts are increasing, while the exports are also heavy; so that production is only adequate to the needs, and prices keep firm, more especially for best kinds. Durham gas coals are quoted from 9s. 3d. to 10s. 3d. per ton f.o.b., according to quality; but where delivery is far forward, a higher price has been asked. There are no contracts of moment to report on this occasion, though one or two are in negotiation. As to coke, the market is firm. Fair gas coke is quoted from 10s. to 10s. 6d. per ton f.o.b. in the Tyne.

Scotch Coal Trade.

There is no report of the coal trade in Scotland this week, the great fair holiday in Glasgow having, by consent, put a stop to business. The shipping reported for the week was 278,930 tons—a decrease of 5909 tons upon the preceding week, but an increase of 31,352 tons upon the same week of last year. For the year to date, the total shipments have been 7,226,933 tons—an increase of 815,958 tons upon the corresponding period of 1905.

School Lighting at West Ham.—The Education Committee of the West Ham Borough Council have accepted tenders to the total amount of £1101 for improving the gas lighting in sixteen of the local schools. Tenders have also been received for improvements to gas-fittings in twelve other schools.

Theft from a Prepayment Meter.

At the Penge Police Court, on Monday last week, James Palmer, a flower seller, was charged on remand with stealing 2s. 5d. from an automatic gas-meter at 7, Clarina Road, and also damaging the meter to the amount of 2s. Frank Clarke, in the employ of the South Suburban Gas Company, said he went to the house in question and examined the two gas-meters. One was intact, but the other was broken open. The latter, according to the index, should have contained 2s. 5d. James Wetherall, a lad, said he and his brother went on the previous Friday to the house, and saw someone creeping into the washhouse. He called out, and prisoner replied that he was looking for a sleep for the night. Witness's parents had lived there, and had moved out the same day. Prisoner ran out of the house by the front door, and witness afterwards saw that the door of the cupboard where the meter was kept was open, and on closing this he noticed the window was open. Detective Allen said he found the prisoner at 39, Arpley Road; and charged him with breaking the meter and stealing money from it. On the way to the station, he said there were others in it besides himself. Prisoner's father said that he thought that the lad's conduct was due to bad company. He had done his best to control him, and he asked the Bench to send him to sea. The Magistrates said they had no power to do this; and prisoner would have go to a reformatory for three years.

Water Supply of Gotha.—In consequence of the periodic scarcity of water which occurs every summer, it has, according to a recent number of the "Norddeutsche Allgemeine Zeitung" been necessary to create a vast reservoir in Thüringia, by impounding the waters of the River Gera. The requisite works have been in course of construction since 1902, and an embankment 262 feet long, 98 feet high, and 65 feet thick, at Tambach, has resulted in the formation of a reservoir with a capacity of 220 million gallons, water from which is conveyed to Gotha by a main some 12½ miles in length. The total cost of the undertaking was upwards of £50,000.

Monmouthshire Water Areas.—At a private conference of Monmouthshire public authorities, held last Wednesday at Newport, the following resolution with regard to the water supplies of the county was passed unanimously: "That, in the opinion of this conference, it is desirable in the interests of the county, and especially of its industrial districts, that the present sources of water supply be conserved, and measures taken for preventing outside companies and bodies from extracting water to which the inhabitants of this county have a natural claim; that the County Council should promote a Bill in Parliament in the ensuing session with a view of securing a good and ample supply of water for the benefit of the county, and that the members of the Council present pledge themselves to use their best endeavours to procure the co-operation and support of their respective Councils in support of the Bill.

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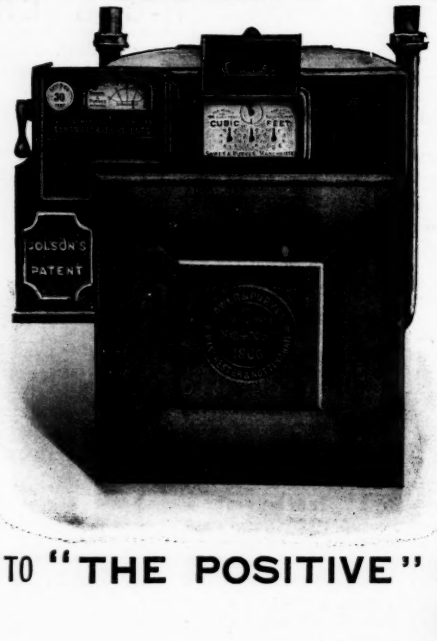

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Street Lighting at Coventry.

The question of gas or electricity for street lighting was under discussion by the Coventry City Council last Tuesday, when the Watch Committee recommended that the offer of the Electric Light Department to supply additional lamps at the present annual rental of £800 be accepted. Alderman Webb Fowler, who proposed the adoption of the recommendation, said a deputation had visited Leicester, and had inspected the system of street lighting there. On comparing it with what they had in Coventry, he considered, and so did the other members of the deputation, that their own system was far preferable. Mr. Hill, in seconding the motion, said one advantage about the scheme submitted by the Electricity Department was that it would obviate the necessity of putting up a number of standards in narrow streets, where they were an impediment. Mr. Batchelor, the Chairman of the Gas Committee, opposed the recommendation, and complained that inasmuch as the report was signed by two members of the Electric Light Committee, it seemed to be biassed, though he did not say this was intentional. In the course of the discussion, reference was made to the remarks of Sir William Preece as to incandescent gas being considered by him preferable to electricity for purposes of street lighting. But Alderman West, the Chairman of the Electric Light Committee, said he believed Sir William had very little experience of street lighting; and therefore he did not regard him as being an expert on this matter. Another point put forward in the discussion was that if the offer were rejected a large quantity of plant would have to be scrapped. On a division, the Committee's recommendation was adopted.

Hoylake and West Kirby Gas and Water Company.

The report of the Directors to be submitted at the meeting next Tuesday, states that the quantity of gas sold during the year to June 30 was 51,624,381 cubic feet, as against 50,658,030 feet in the preceding twelve months; and of water, 242,160,000 gallons, compared with 247,840,000 gallons. The proprietors, by special resolutions passed last October, authorized the Directors to apply to the Board of Trade for a Provisional Order empowering the Company to construct and maintain additional water-works on land at Newton, and providing for the necessary increase of capital. The Board now report that the Provisional Order has been approved by the Board of Trade on the terms sought; and the Bill confirming it was introduced into the House of Lords on May 3, and passed the second reading on the 29th of that month. Since the last report, the boring at Newton has been sunk to a depth of 700 feet from the surface, and the water satisfactorily tested as to quantity and quality. Owing to serious difficulty with water in the subsoil at the Hoylake Gas-Works, a change is this year being made in the system of retort-furnace firing in respect of those beds due for re-setting this season; and it is expected this system will be gradually extended throughout the retort-house. The dividends recommended, with the interim distribution, will represent for the year to June 30 the following rates, less income-tax: Gas capital, "A" original, 11 per cent.; "B" additional, 8 per cent. Water capital, "A" original, 10 per cent.; "B" additional, 7 per cent. The net revenues for the year were: Gas, £2163; and water, £4416. The total income, including the amounts brought forward, was £7348; and after payment of the dividends, and the transfer of £815 to reserve and contingency funds, there will remain a balance of £468, which will be taken forward to the next accounts.

Charge for Water for Laundry Purposes.

At the Altrincham Petty Sessions recently, a claim was made by the North Cheshire Water Company against Mrs. E. Torn, of Sale, in respect of an account rendered for water used for washing and laundry work. The Company's collector (Mr. J. Hunt) said the question for decision was whether they were entitled to make a separate charge against the occupier of a house whose ordinary water account was discharged by the landlord. In support of the contention that they were, he cited numerous cases heard in the Altrincham, Stockport, and other Courts, in which it had been held that water used in connection with laundry work introduced into a house, and other than that belonging to the tenant, was liable to a separate levy. Clause 12 of the Water-Works Clauses Act, 1863, specified that "A supply of water for domestic purposes shall not include a supply of water for cattle, or for horses or for washing carriages, when such horses or carriages are kept for sale or hire or by a common carrier, or a supply for any trade, manufacture, or business, or for watering gardens, for fountains, or for any ornamental purpose." It was on the latter part of the clause that he based his claim. There was no question before their Worships of the defendant's poverty or inability to discharge the debt. There was a refusal to recognize the Company's right to make the charge; and upon this he asked the Justices to say he was entitled to the usual order. The Chairman (Mr. Bulkely Allen) inquired whether the Manchester Corporation made a separate charge for water used for washing purposes. Mr. Hunt said they did, and it was the general custom of all corporations and water companies to levy a special rate; and the average charges were higher than those of the North Cheshire Water Company. The Chairman said it was quite clear that the defendant was liable, and must pay the amount claimed. The Bench had no option in the matter. The defendant was ordered to discharge the debt, with the usual costs, within a fortnight, to the end of which time the case was formally adjourned.

Last Wednesday evening, about eight o'clock, a fire broke out in the large drapery establishment of Messrs. Grose Bros., in the Walworth Road, and before it could be extinguished seven large shops were gutted, and damage done to the estimated amount of £30,000. The fire is reported to have been caused by a defective electric circuit in the shop window.

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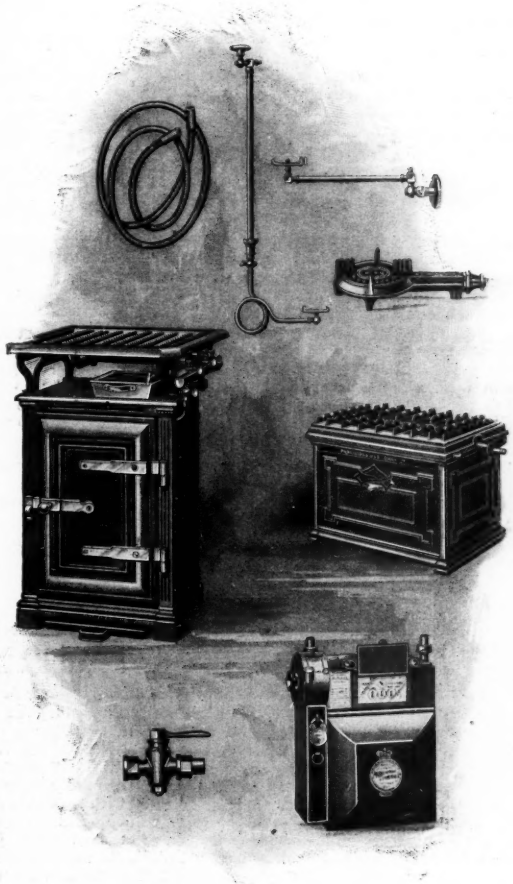

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Suicide by Gas.—"Suicide during temporary insanity" was the verdict of the Jury who inquired into the death of a fitter named Korff at Lincoln. Deceased, when left alone in his house, thrust his coat against the chimney, closed the windows and doors, and turned on the gas. When found later, he was quite dead.

Gas-Works Results at Driffield.—The report of the Manager (Mr. E. W. Wright) on the operations of the Driffield Gas-Works during the past twelve months shows a reduced revenue by £149 from gas and residuals, and a falling off in gross profit of £44, as compared with the preceding year. The make of gas was 24,959,000 cubic feet and 26,609,000 cubic feet respectively. There was an increased make of 276 feet per ton of coal carbonized; while owing to a very substantial reduction in the percentage unaccounted for, the sale per ton of coal was 550 feet more.

Liverpool to Supply Birkenhead with Water.—The Liverpool Water Committee have offered to supply Birkenhead with Vyrnwy water, though the terms have not yet been agreed upon between the parties. It is stated, however, that no limit will be put on the quantity or the period of supply. The Wallasey district is already supplied with Vyrnwy water; and as the pipes conveying it pass along the western boundary of Birkenhead, the making of the necessary junction to serve the latter place is not expected to involve the expenditure of much time or money.

The Uxbridge Tragedy.—The Coroner's Jury have completed their inquiry into the death of Edward M. Williams and his wife and two children, who were found dead under circumstances that have been already recorded in the "JOURNAL." The Jury returned two verdicts—the first was that Williams murdered his wife and children by administering morphine; and the second that he committed suicide while of unsound mind. Williams, when found, was suffering from coal-gas poisoning; he having disconnected the gas-pipe of the room, after killing his wife and children.

Hindley Gas Supply.—In his annual report, Mr. H. O. Timmins, Manager of the Hindley Gas-Works, states that at the beginning of the year there were on the register 2493 consumers by ordinary meter, and 1376 by automatic meter; and at the end of the year 2455 by ordinary, and 1638 by automatic meter—giving a decrease by ordinary of 38, and an increase by automatic meter of 262. This was a total increase of 224, or 5·79 per cent., thus making manifest the increasing popularity of the automatic meter. In a separate report, the Clerk (Mr. T. Robey) points out that last year the gas-works showed a loss of £571, whereas this year there is a profit of £29 after paying increased interest and sinking fund charges to the extent of £417. Thus there is a total gain of £1017.

A Fatal Gas Explosion.—At the Westminster Coroner's Court, on Monday of last week, an inquiry was held into the death of Mr. F. G. Enys, who died from the effects of injuries received in a gas explosion at a private hotel in Bury Street, St. James's, on Sunday, the 8th inst. The evidence showed that the water-slide chandelier in the room in which the accident occurred had been pulled down; and the Coroner suggested that deceased (who was a short man) might have put it in this position to light it, and thus have allowed a quantity of gas to escape while he was seeking a match. It was stated by the proprietor of the hotel that there was water in the chandelier at the time. The doctor stated that death took place from heart failure, consequent on burns and shock. The Jury returned a verdict of "Accidental death."

Exeter Public Lighting.—At the meeting of the Exeter City Council last Wednesday, the Joint Lighting Committee suggested the general terms of the proposed agreement with the Gas Company for lighting with gas the streets other than those along which electric cables are laid—viz.: (1) That the period be for five years certain; (2) that the agreement is to apply to all existing streets along which electric cables are not at present laid; (3) that of the Company's alternative quotations that for lamps with controllers be accepted; and (4) that, in accordance with the Company's suggestion, the payment of the cost of converting the lamps, including the fitting of them with controllers, be spread over a period of five years. The general terms of the suggested agreement were adopted; and the settlement of the details was left with the Lighting Committee.

Pontypridd Water Company and Lead Poisoning.—A good deal of uneasiness has, it appears, been caused among the inhabitants of the Trealaw area, who are supplied with water by the Pontypridd Water Company, as to the danger of lead poisoning. Mr. W. P. Nicholas, the Clerk to the Rhondda Urban District Council, has reported that there is a good deal of dissatisfaction in the neighbourhood with regard to cases in the district. Already the Health Committee are dealing with the matter; but in the meantime the Medical Officer of Health (Dr. J. D. Jenkins) has considered it advisable to issue circulars in the area affected advising the consumers to draw off about a gallon of water from the pipes in the morning before using it for drinking purposes. In the event of an objection being raised to the circular by the Water Company, Mr. Nicholas has advised the Medical Officer to obtain the sanction of the Council in the matter.

Price of Coke at Bingley.—The policy of the Bingley Gas Committee in keeping the charge for coke at one figure to ratepayers and disposing of large quantities by contract outside the district at a considerably lower price has been the subject of criticism in the Council. A Mr. Garnett, in sending a cheque for the payment of his account for coke, had written stating that this treatment of the ratepayers was a scandal, and that he should certainly have accepted service of a summons for non-payment had he been sure that he would have been at home to appear in answer to the summons. Mr. Towler, the Chairman of the Gas Committee, defended the system adopted, as giving better financial results than the former practice of reducing the price when stocks accumulated until the surplus coke was cleared. Mr. Dawson said he had previously maintained that it was unfair to sell coke at a cheaper rate to persons outside the district than to their own ratepayers. He moved that the question be referred to the Gas Committee for reconsideration. Mr. Brigg seconded this proposal, and it was carried.

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Accrington Gas and Water Supply.—The Accrington and District Gas and Water Board last year made 500 million cubic feet of gas, which yielded an income of £49,613. The Board's total daily consumption of water is nearly 1½ million gallons; and at the time their report was issued there was an increase of 34¼ million gallons over the previous year.

Slot Gas-Meter Prevents Suicide.—A case is reported of an attempt at suicide by gas in Pentonville being frustrated by a penny-in-the-slot meter. It appears that a man purchased a length of rubber tubing, which he attached to the gas-jet in his room. He then dropped a penny into the meter, turned the gas on, and put the end of the tube in his mouth. He was unconscious when discovered; but hopes were entertained of his recovery. He would have been suffocated had it not been for the fact that the pennyworth of gas became exhausted.

Conservation of Welsh Water.—Following the example of Glamorganshire, representatives of local authorities in Monmouthshire held a conference last Wednesday to consider the question of the conservation of the water sources of the county. On the motion of Mr. Alfred Onions, seconded by Sir H. Mather Jackson, it was resolved—"That in the opinion of this conference it is desirable, in the interests of the county, and especially its industrial districts, that the present sources of water supply should be conserved, and all measures taken for preventing outside companies or bodies from abstracting water to which the inhabitants of the county have a natural claim; that the County Council should promote a Bill in Parliament in the ensuing session with the view of securing a good and ample supply of water for the benefit of the county; and that the members of the District Councils present pledge themselves to secure the co-operation and support of their respective Councils in the promotion of such Bill."

Sales of Stocks and Shares.—At the Mart, Tokenhouse Yard, E.C., last Tuesday, Mr. Alfred Richards sold by auction, by order of the Directors, £3270 of 4 per cent. perpetual debenture stock of the Aldershot Gas and Water Company, at from £100 to £102 10s. per £100 of stock. On the same occasion, he sold some £10 fully-paid 7 per cent. preference shares in the Colombo Gas and Water Company, Limited, at from £10 5s. to £10 10s. per share; some "A" and "C" stock of the Barnet District Gas and Water Company (last dividend 7½ per cent.) at £160 and £161 per £100; some "D" water capital (last dividend £5 5s. per cent.), at from £108 to £110 10s., and part of the recent allotment of similar capital at £110 per £100. The preceding day, Messrs. Fleuret, Sons, and Adams sold some additional ordinary £10 shares in the North Middlesex Gas Company at £14 each, shares of similar nominal value in the Woking Water and Gas Company at £10 13s. per share, and £600 of debenture stock of the same Company at £103 per £100.

Public Lighting of Tottenham.—At the meeting of the Tottenham Urban District Council on Tuesday, the Clerk stated that he had asked the Tottenham and Edmonton Gas Company for their terms for lighting, cleansing, repairing, and maintaining the public lamps for the year ended June 30, 1907. He had intimated in his letter to the Company that, having regard to the recent reduction in the price of gas to private consumers, the Council would anticipate a *pro rata* reduction in the cost of public lighting. The Secretary of the Company had replied, offering to light and cleanse the lamps on reduced terms, except in the case of the Lucas lamps; but the prices for repair and maintenance would be the same as for the previous year. The Engineer to the Council reported that the prices quoted showed approximately a reduction of 1⅛d. per 1000 cubic feet of gas, as against 2d. to private consumers; but the Company's tender is now based on a charge of 2s. 1d. per 1000 cubic feet to the Council, against 2s. 8d. to private consumers. It was resolved to accept the tenders.

The Directors of the Seville Water-Works Company recommend a dividend at the rate of 1 per cent. per annum on the share capital for the year ended March 31 last. A balance of £4299 will remain to be carried forward.

The village of Gotham, in Nottinghamshire, has been on the verge of a water famine, and the Great Central Railway Company are sending each day a tender filled with water to the point nearest the village, whence the water is conveyed by means of a pipe.

It will be seen, from an announcement which appears elsewhere, that the Bournemouth Gas and Water Company are inviting tenders for an issue of £20,000 of 4 per cent. perpetual debenture stock, at a minimum price of £103 per £100. The money is required in connection with the completion of new works, and to meet the ordinary extension of business; and the tenders for the stock are to be sent in by Thursday morning, the 9th prox.

A new catalogue has recently been published by the Cambridge Scientific Instrument Company, Limited, on technical thermometry. The first part is devoted to showing the many applications of electrical thermometers; and, among other instruments, the Féry radiation pyrometer is described and explained in detail. The list is divided into three sections. The first deals with the more particular applications of pyrometers; the second, with scientific or research work; the third is an appendix explaining the theoretical considerations of the instruments, and giving tables of general interest. Among the latter, there is a table of melting points kindly handed to the Company by Dr. Harker, of the National Physical Laboratory. These values, it is pointed out, differ very materially from those generally accepted in text-books. Particulars are also given of a patent thread recorder, for continuous registration of temperatures obtained with thermo-electric thermometers and Féry radiation pyrometers. With regard to the latter, it is stated that at the Cambridge Gas-Works it has been found that this pyrometer can be carried round the retort-house in the hand, sighted upon the part of an open retort of which it is desired to obtain the temperature, and the temperature determined in twenty seconds. There is also reproduced in the catalogue (by permission of the South Metropolitan Gas Company) an interesting portion of a record, taken with a resistance thermometer and Callendar recorder, of the temperature of a gas-retort furnace.

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Companies Meetings.
BRENTFORD GAS COMPANY. Charing Cross Hotel, Aug. 3, 2.30 o'clock.
BROMLEY GAS CONSUMERS' COMPANY. Bromley, Aug. 9, 6 o'clock.
GASLIGHT AND COKE COMPANY. Offices, Aug. 3, Twelve o'clock.
WEST HAM GAS COMPANY. Liverpool Street Hotel. Aug 9, 12.30 o'clock.
SOUTH SUBURBAN GAS COMPANY. Albion Tavern, Aug. 10, 3 o'clock.

Share Warrants to Bearer.
EUROPEAN GAS COMPANY.

Stocks and Shares.
BOURNEMOUTH GAS AND WATER COMPANY. Tenders by Aug. 9.

TENDERS FOR

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SHEFFIELD UNITED GAS LIGHT COMPANY. Tenders by Aug. 8.
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